



A Program of ASTM International

Test Monitoring Center

<https://www.astmtmc.org>

ASTM D02.B.03 Semiannual Report Gear Reference Oil Testing

April 2025

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Gear Oil Testing Executive Summary

- ▶ Several reference oils are in the process of being updated to replace older reference oils
 - Approval testing underway for OSCT
 - Reference oils approved this period for L-37-1, L42, and L-60-1

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Gear Oil Testing Executive Summary

▶ L-37-1:

- 155-2 was approved as a reference oil in February 2025
 - 155-2 was approved for both MnP coated hardware and uncoated hardware
 - 155-2 will use the same targets as 155-1.

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Gear Oil Testing Executive Summary

- ▶ L-42:
 - 119-1 was approved as a discrimination oil in November 2024

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Gear Oil Testing Executive Summary

- ▶ L-60-1:
 - Reference 145 was approved by the surveillance panel in February 2025

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Gear Oil Testing Executive Summary

▶ OSCT:

- Investigations underway to find the root cause of the severity shift with testing on Nitrile elastomer. Specifically for SAHA and PELA.
- The stats group has looked at this data but has requested that the test labs first look internally to see if they can find a root cause for the shift in the data that began around 2022.

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Calibrated Labs and Stands*

Test	Labs	Stands
L-33-1	3	8
L-37-1	4	4
L-42	4	4
L-60-1	4	10
OSCT	2	5
HTCT	1	0

*As of 03/31/2025

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L-33-1

➤➤ April 2025

L-33-1 Test Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	10
Unacceptable Calibration Test	OC	7
Unacceptable Calibration Test (Not In Stats)	MC	1
Operationally Invalid Calibration Test (TMC judgement)	RC	1
Operationally Invalid Calibration Test (TMC and lab judgement)	LC	1
Aborted Calibration Test	XC	1
Acceptable Hardware Approval Run	NI	3
Total		24

L-33-1 Failed Tests

Test Status	Validity Code	#
Unacceptable Calibration Test (Mild Rust)	OC	1
Unacceptable Calibration Test (Precision)	OC	5
Unacceptable Calibration Test (Severe Rust)	OC	1
Total		7

L-33-1 Lost Tests

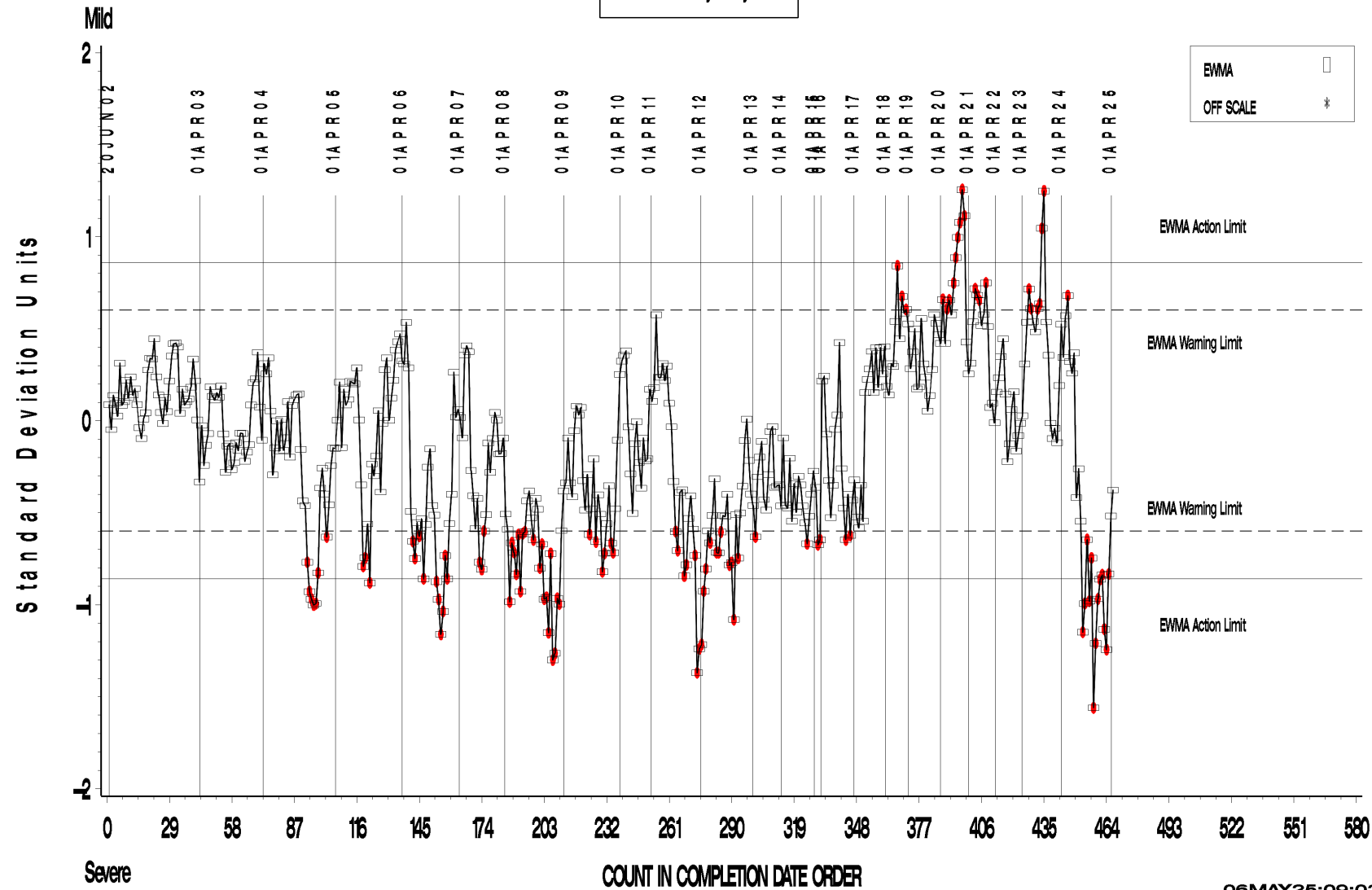
Test Status	Validity Code	#
Pinion turning torque out of spec	RC	1
Motoring Temp % Out	LC	1
Oil Temp out of spec	XC	1
Ref oil 126 run on K2XX hardware	MC	1
Total		4

L-33-1 Test Severity

- Rust industry severity had several tests outside of the action limit in the severe direction this reporting period but finished within limits.
- Rust industry precision exceeded the EWMA warning limit this period but finished the period within limits.

FINAL RUST RESULT

LTMS Severity Analysis

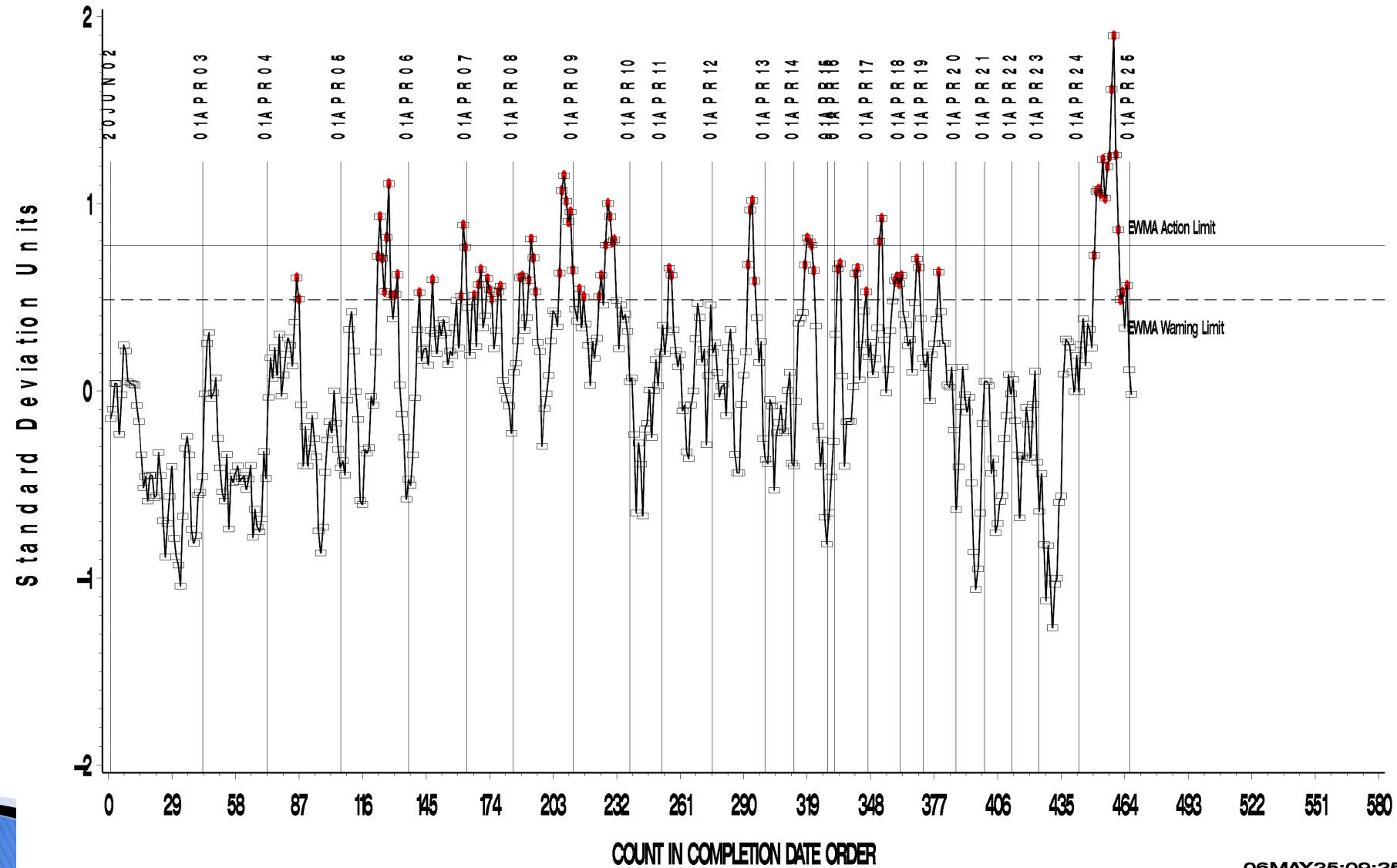


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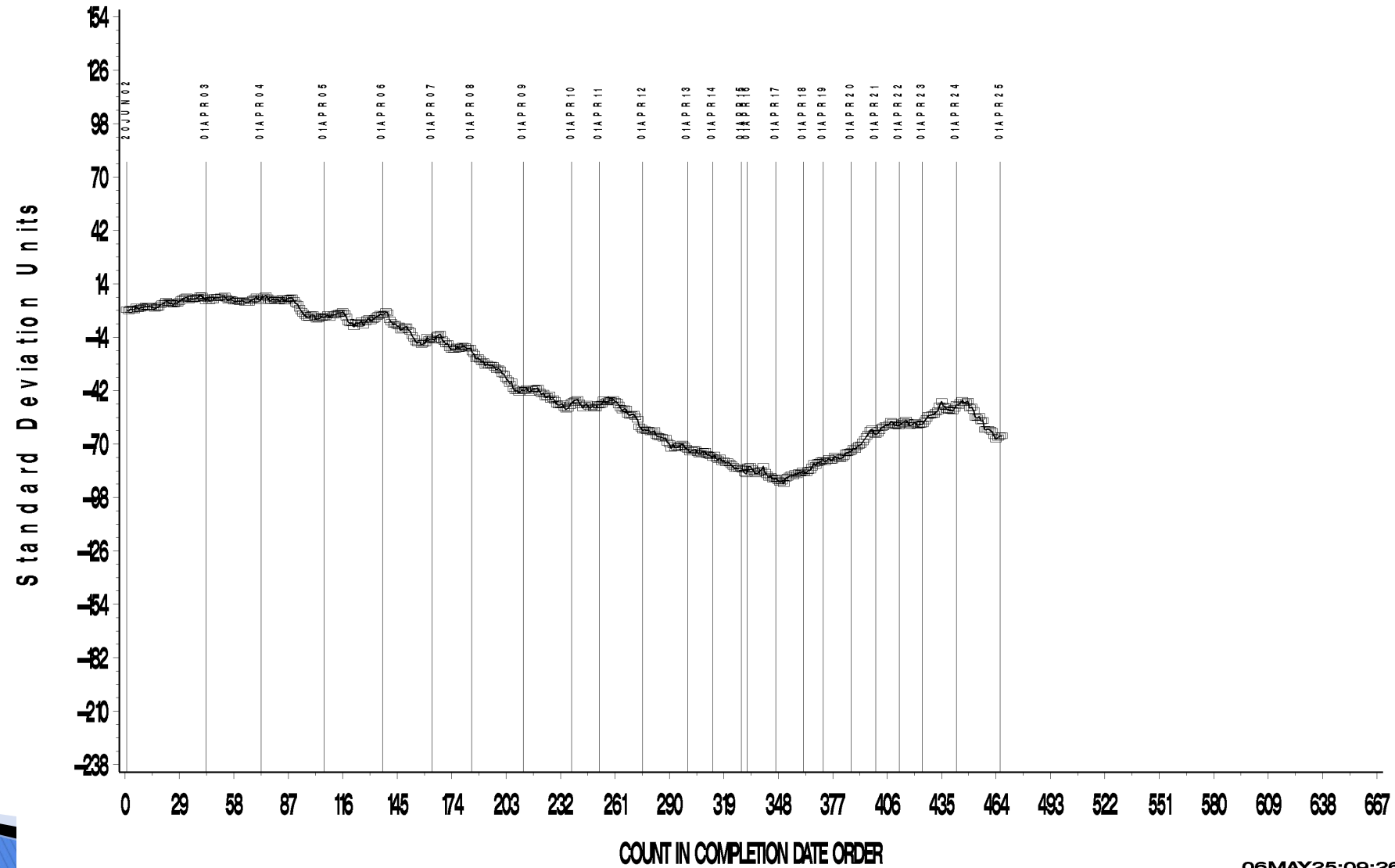
FINAL RUST RESULT

LTMS Precision Analysis

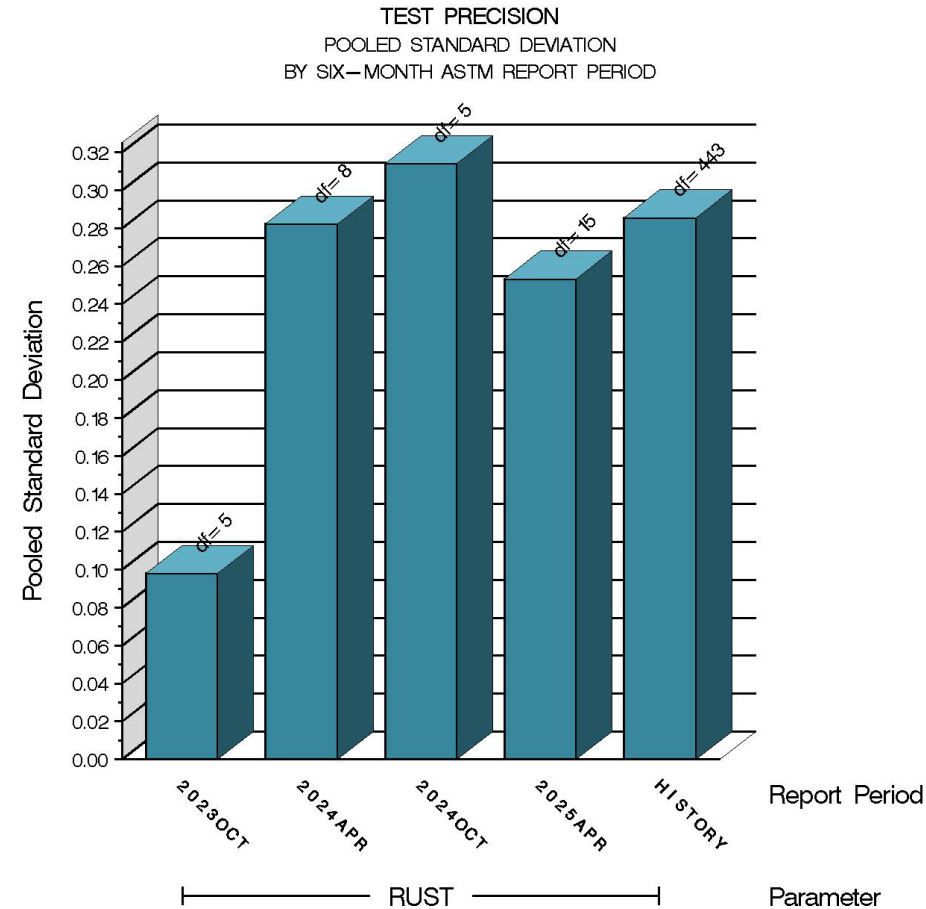


FINAL RUST RESULT

CUSUM Severity Analysis



L-33-1 Precision Estimates



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L-37-1

➤➤ April 2025

L-37-1 Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	11
Unacceptable Calibration Test	OC	2
Acceptable Information Run	NI	0
Aborted Calibration Test	XC	1
Total		14

L-37-1 Failed Tests

Test Status	Validity Code	#
Mild Wear & Mild Spit	OC	1
Severe Ridg	OC	1
Total		2

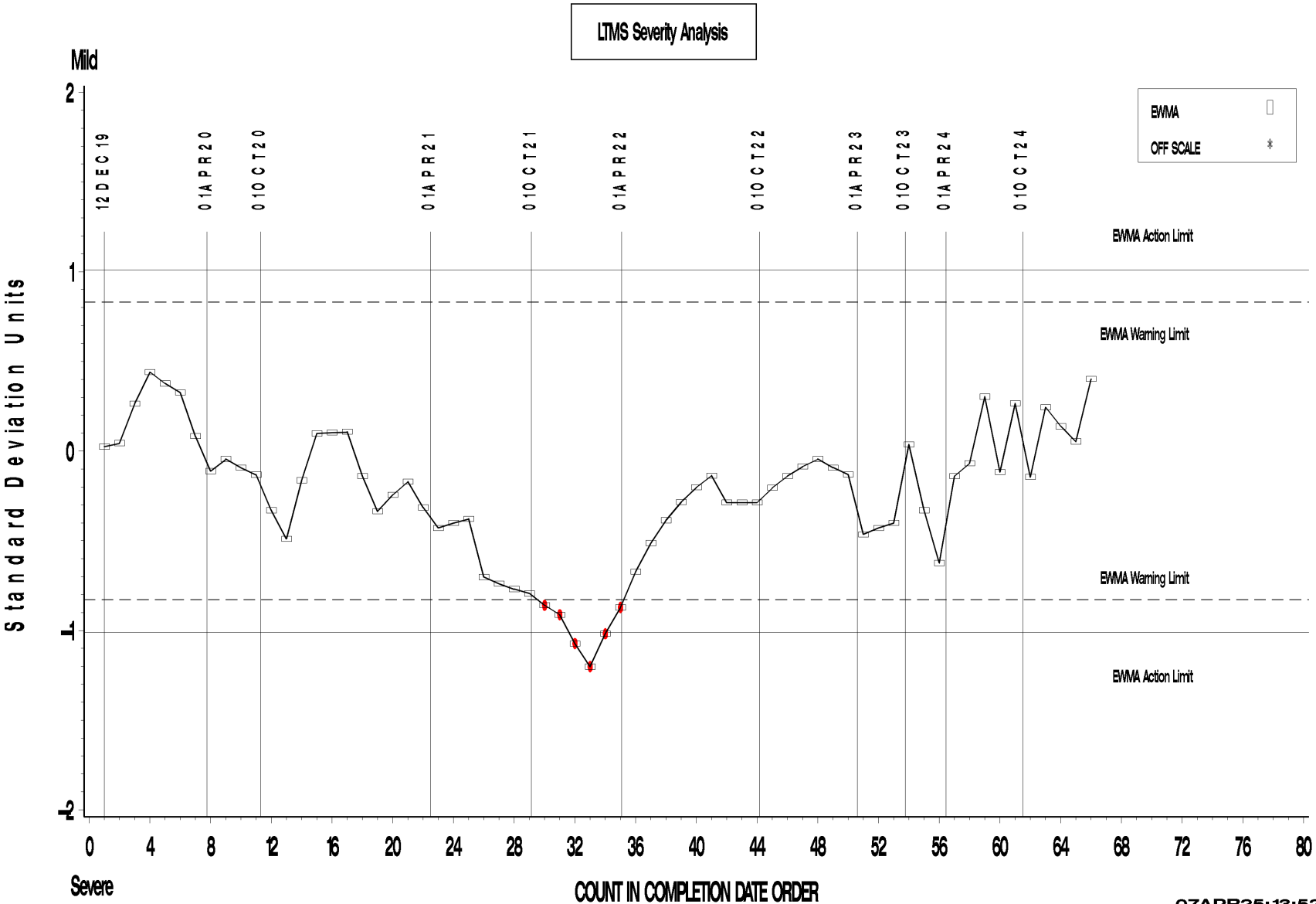
L-37-1 Lost Tests

Test Status	Validity Code	#
Aborted due to broken teeth	XC	1
Total		1

L-37-1 Test Severity Summary

- Uncoated Hardware:
 - All parameters remained within the limits this period for both precision and severity
- Coated Hardware:
 - Wear precision exceeded the action limit this period, but finished the period within limits.
 - All parameters remained within the limits for severity during this reporting period.

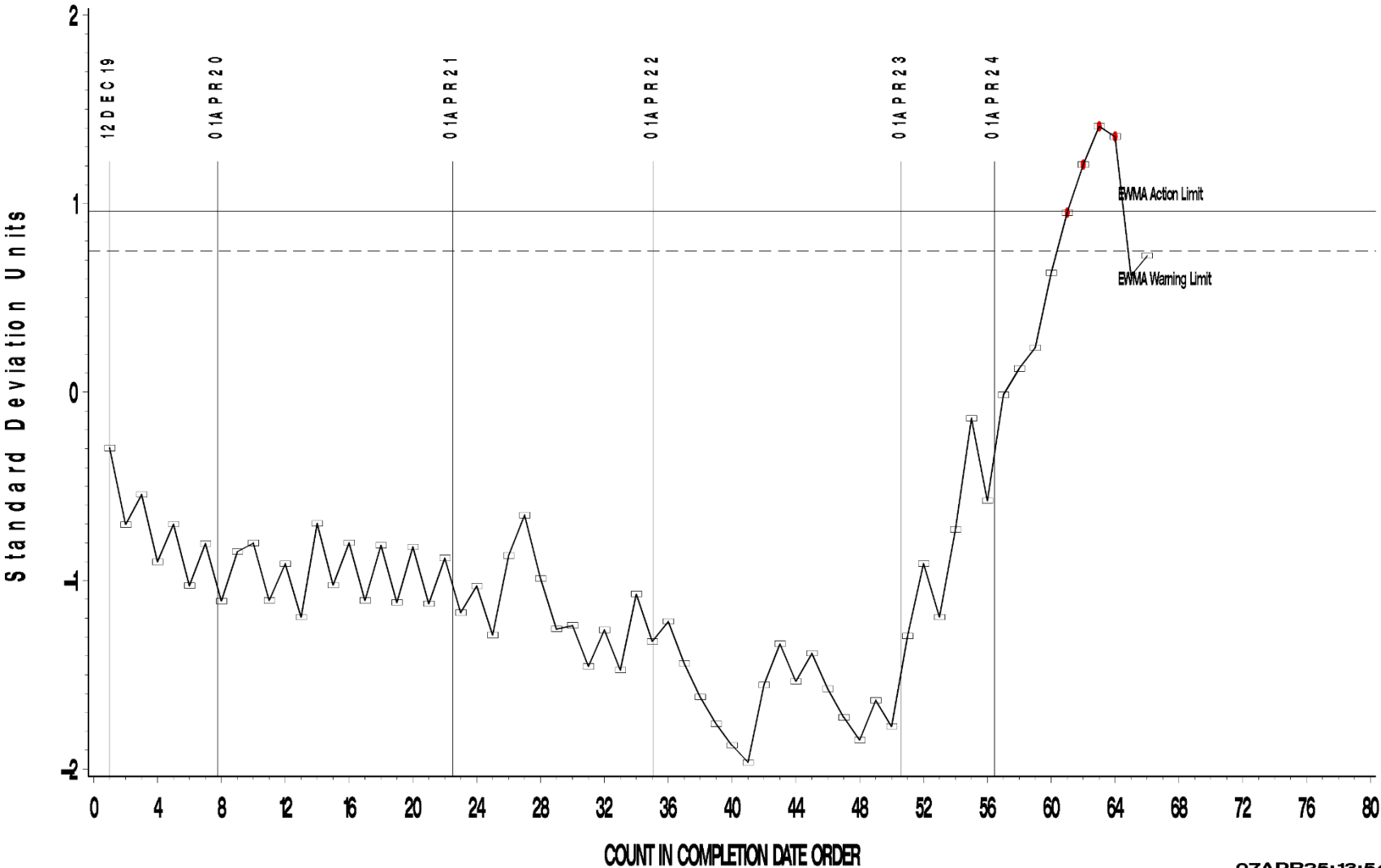
FINAL PINION GEAR WEAR





FINAL PINION GEAR WEAR

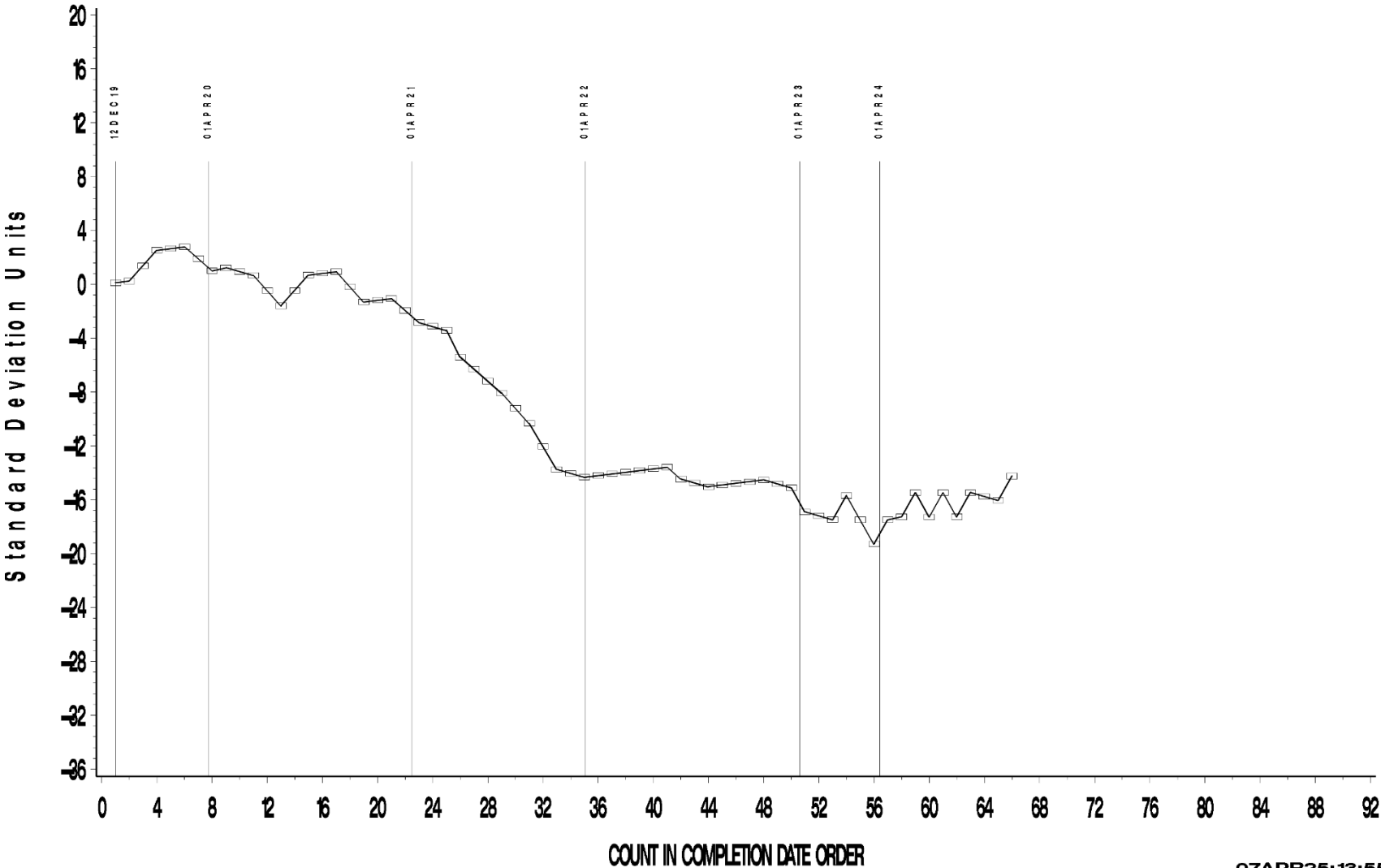
LTMS Precision Analysis



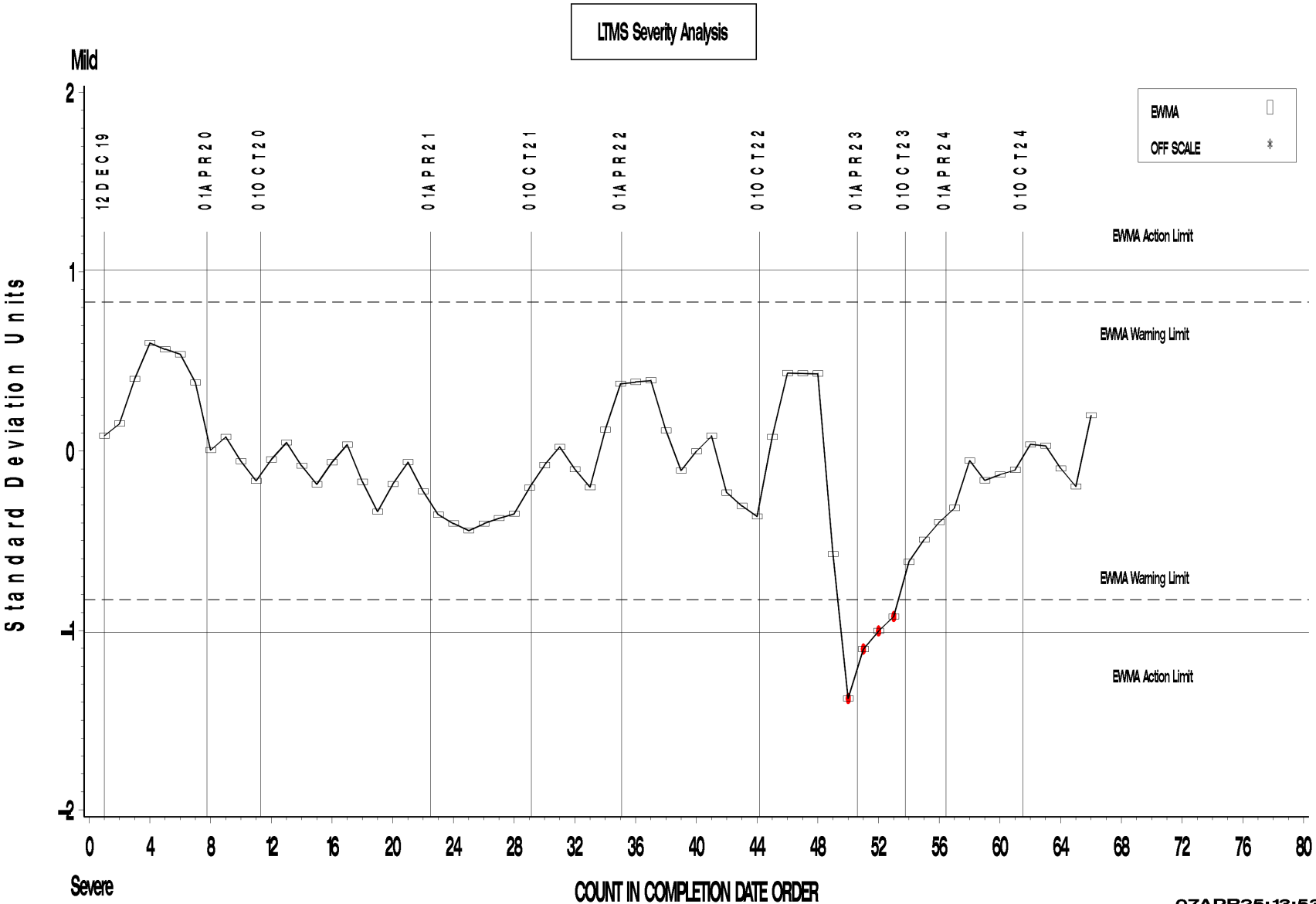


FINAL PINION GEAR WEAR

CUSUM Severity Analysis



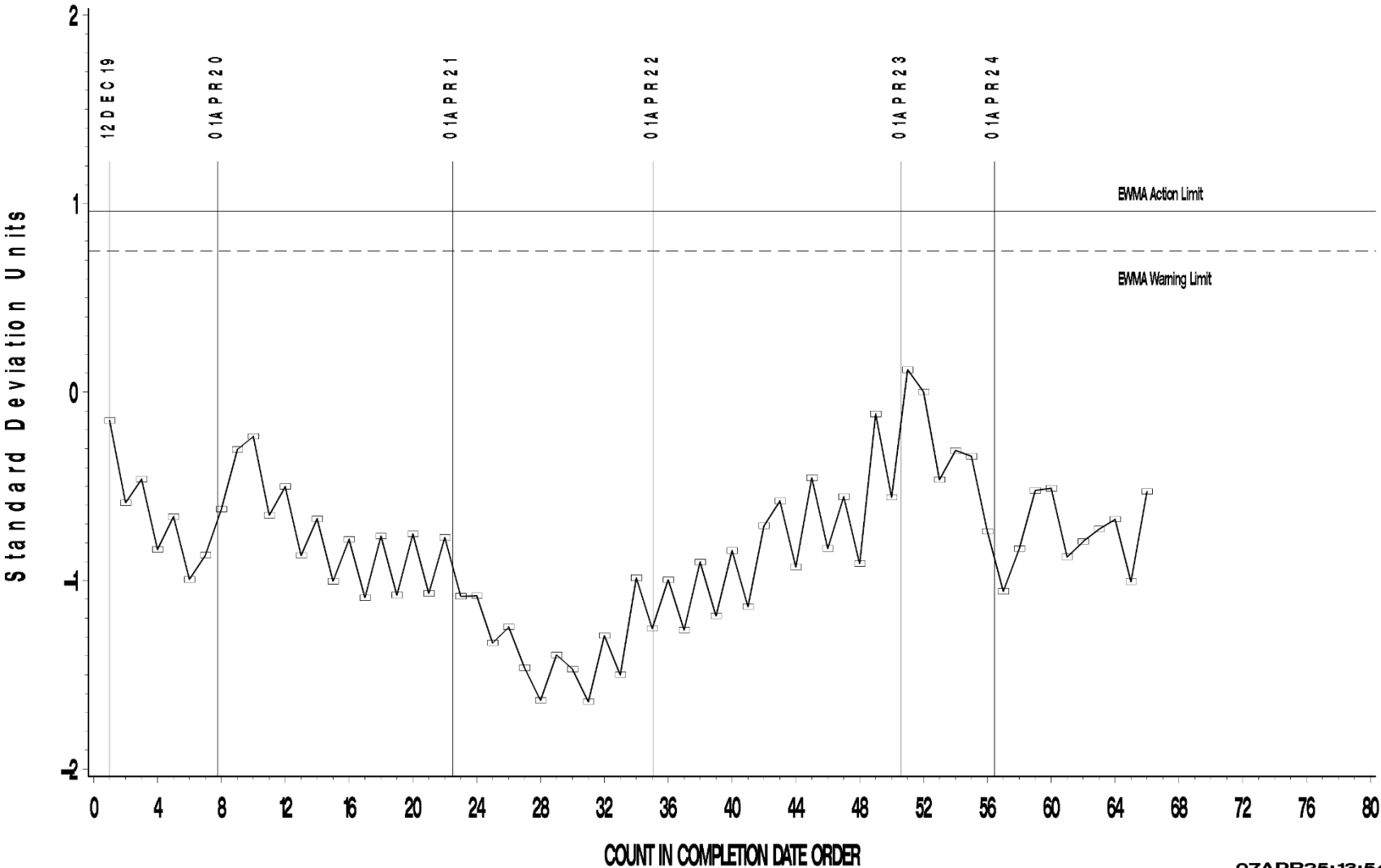
FINAL PINION GEAR RIPPLING





FINAL PINION GEAR RIPPLING

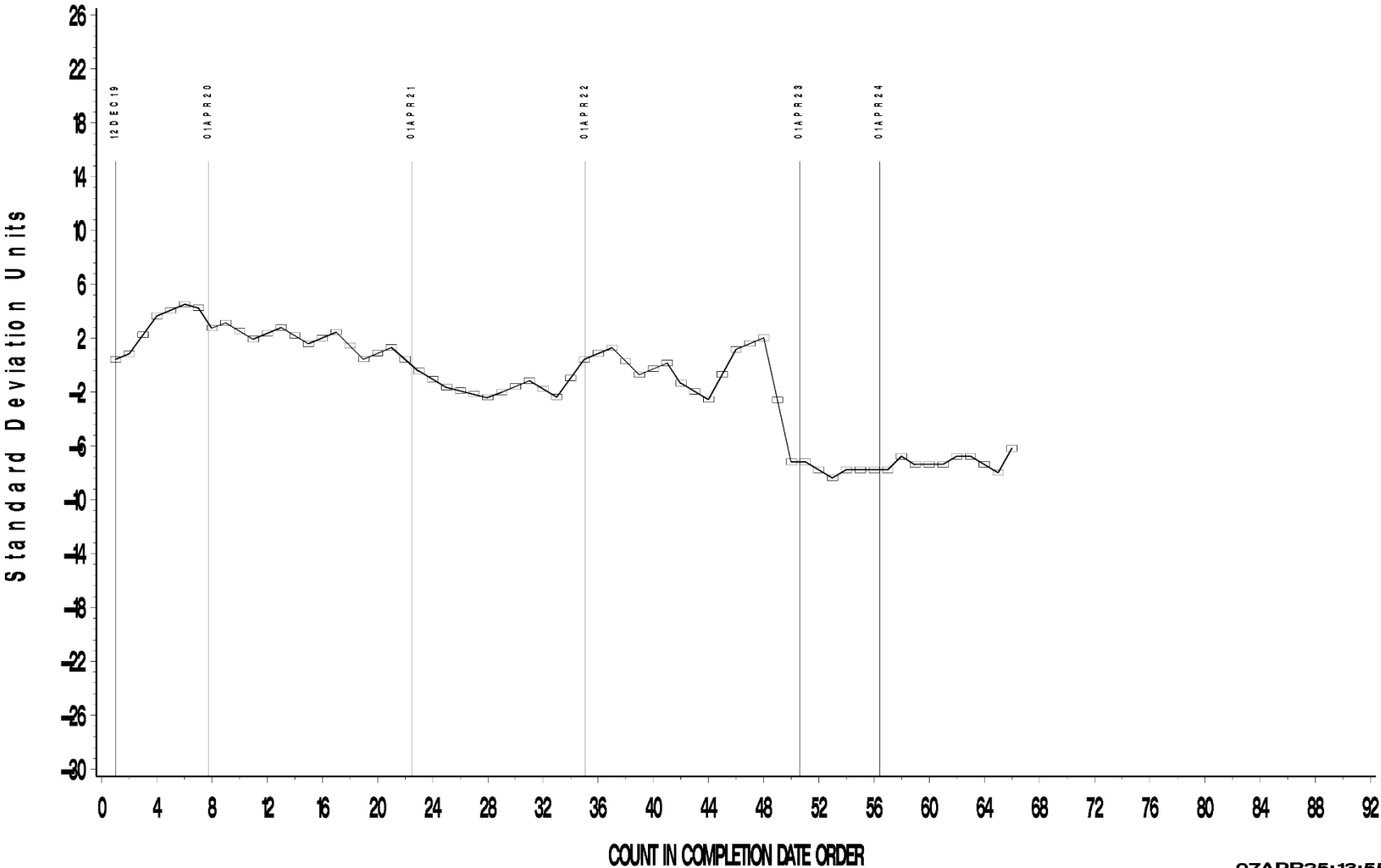
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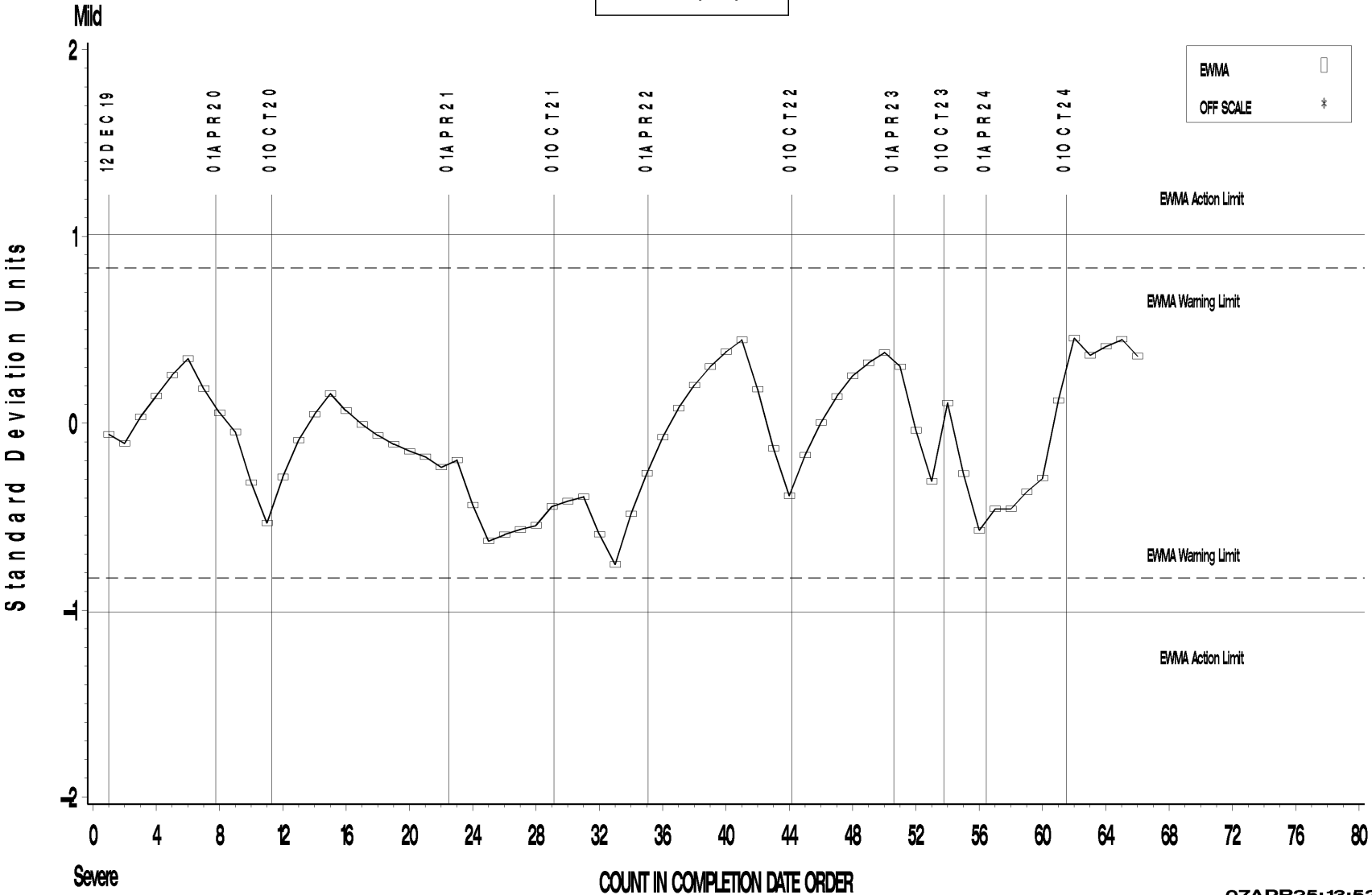
CUSUM Severity Analysis





FINAL PINION GEAR RIDGING

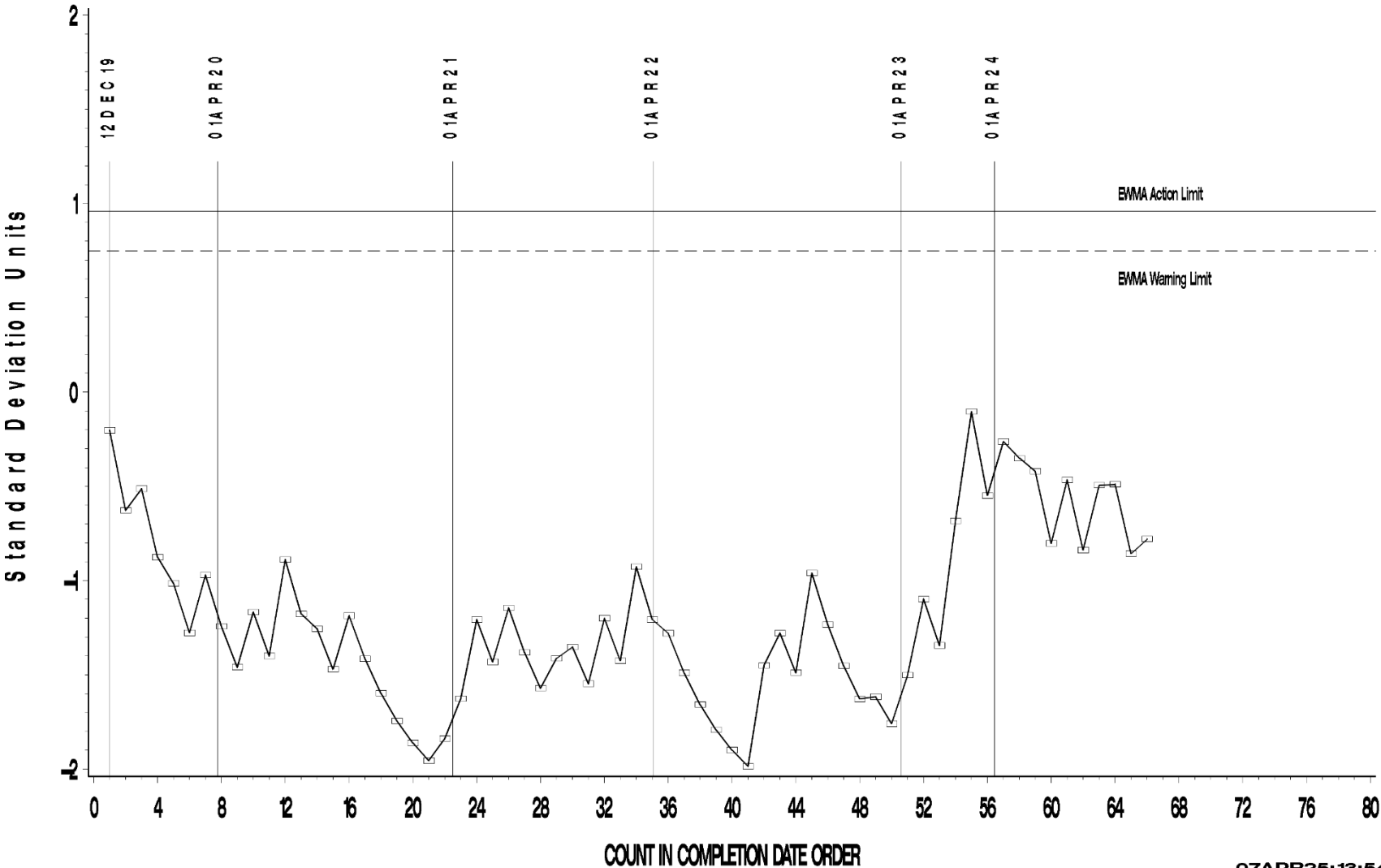
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FINAL PINION GEAR RIDGING

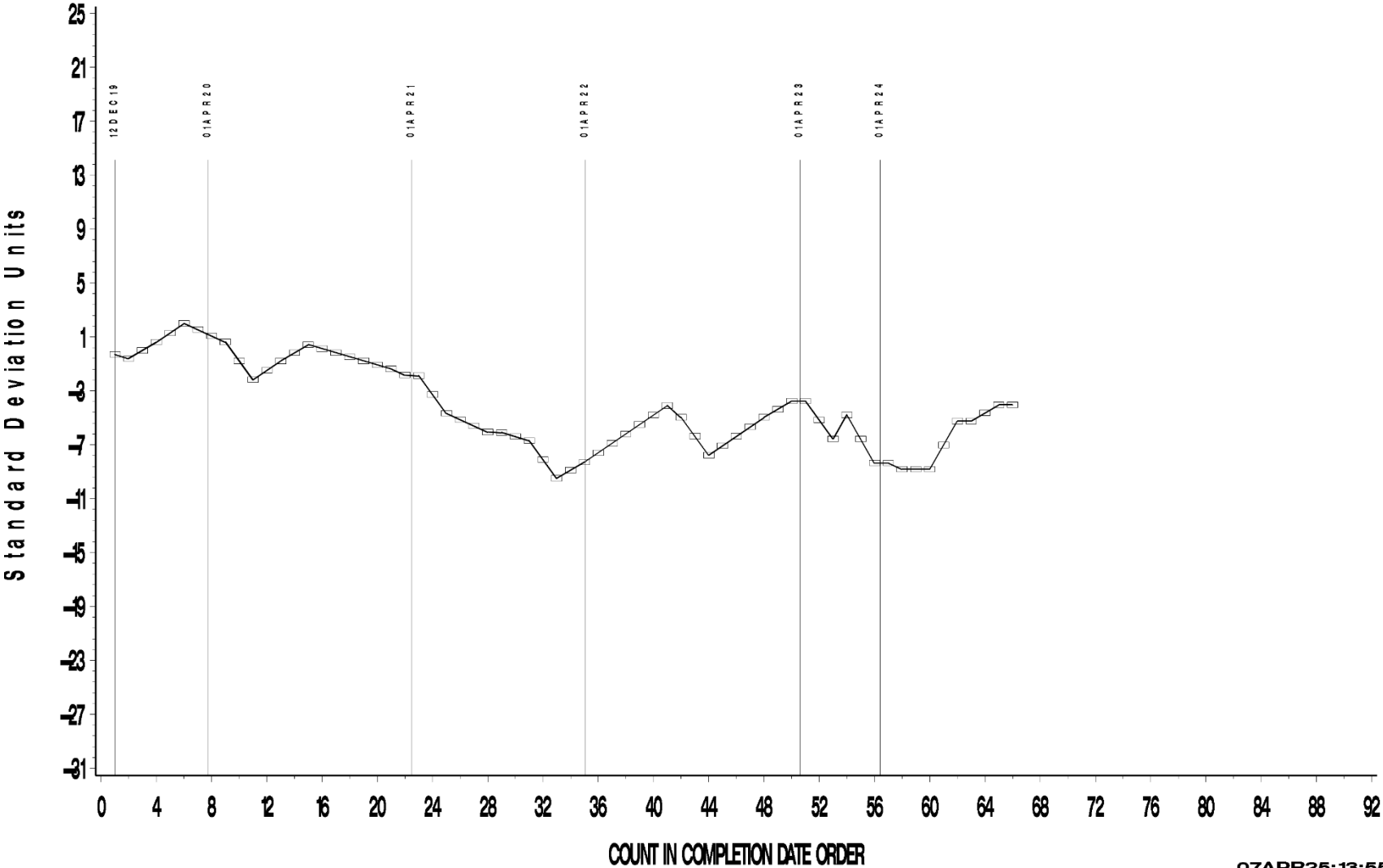
LTMS Precision Analysis



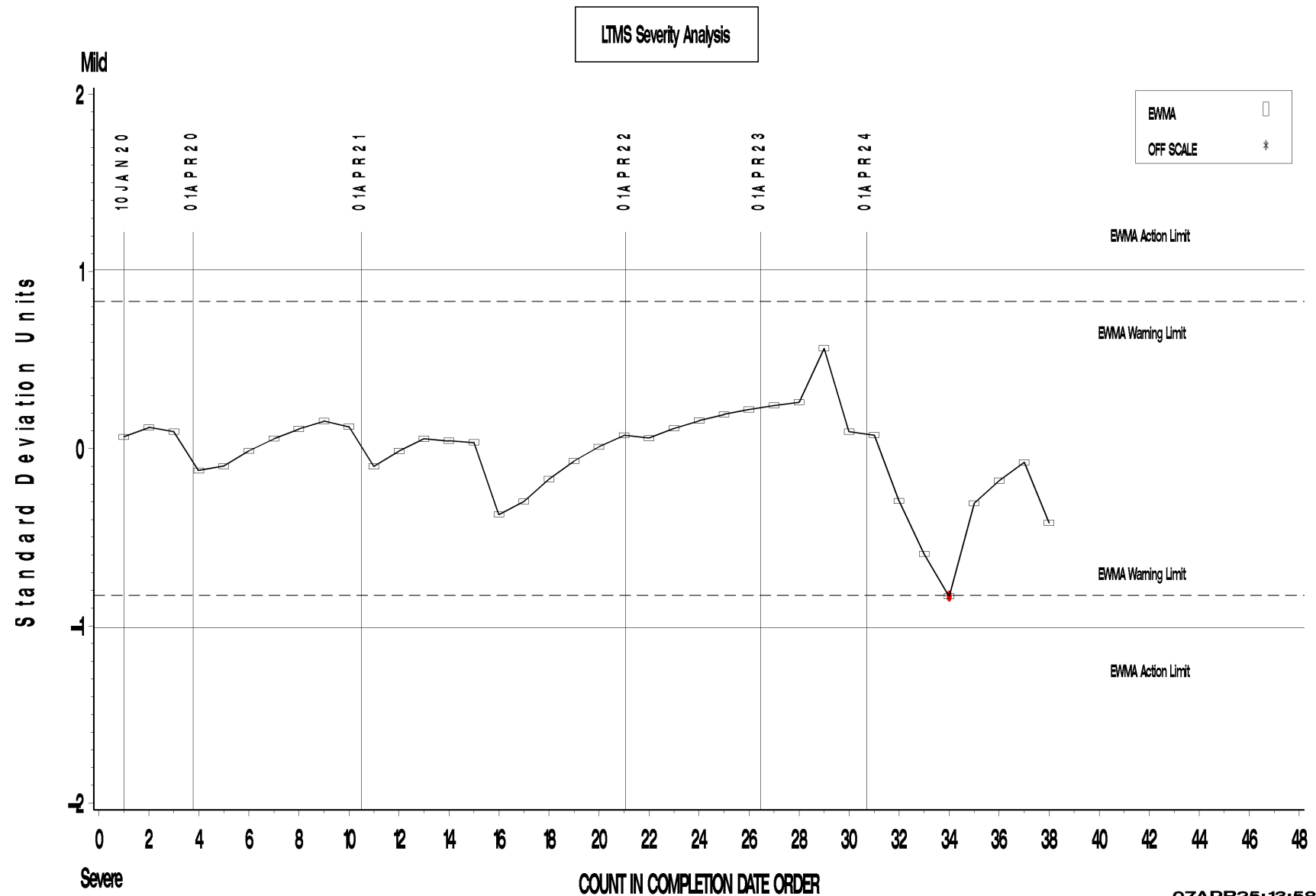


FINAL PINION GEAR RIDGING

CUSUM Severity Analysis



L-37-1 MNP COATED INDUSTRY OPERATIONALLY VALID DATA
IND not = '155-1
FINAL PINION GEAR PITTING/SPALLING

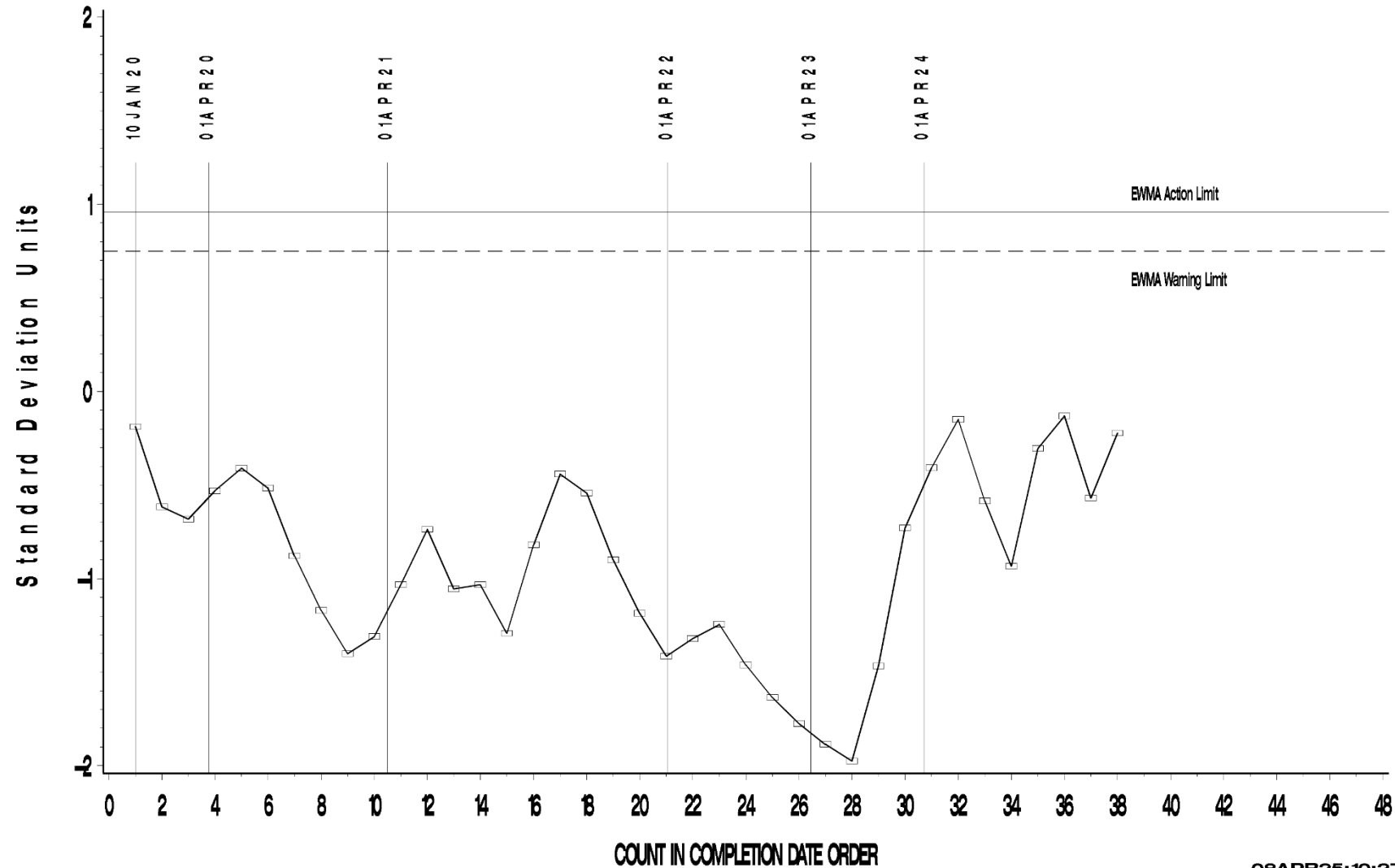


Results for 155-1 are not included in this SPIT chart due to its current targets yielding undefined calculations.

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IND not = '155-1'
FINAL PINION GEAR PITTING/SPALLING



LTMS Precision Analysis



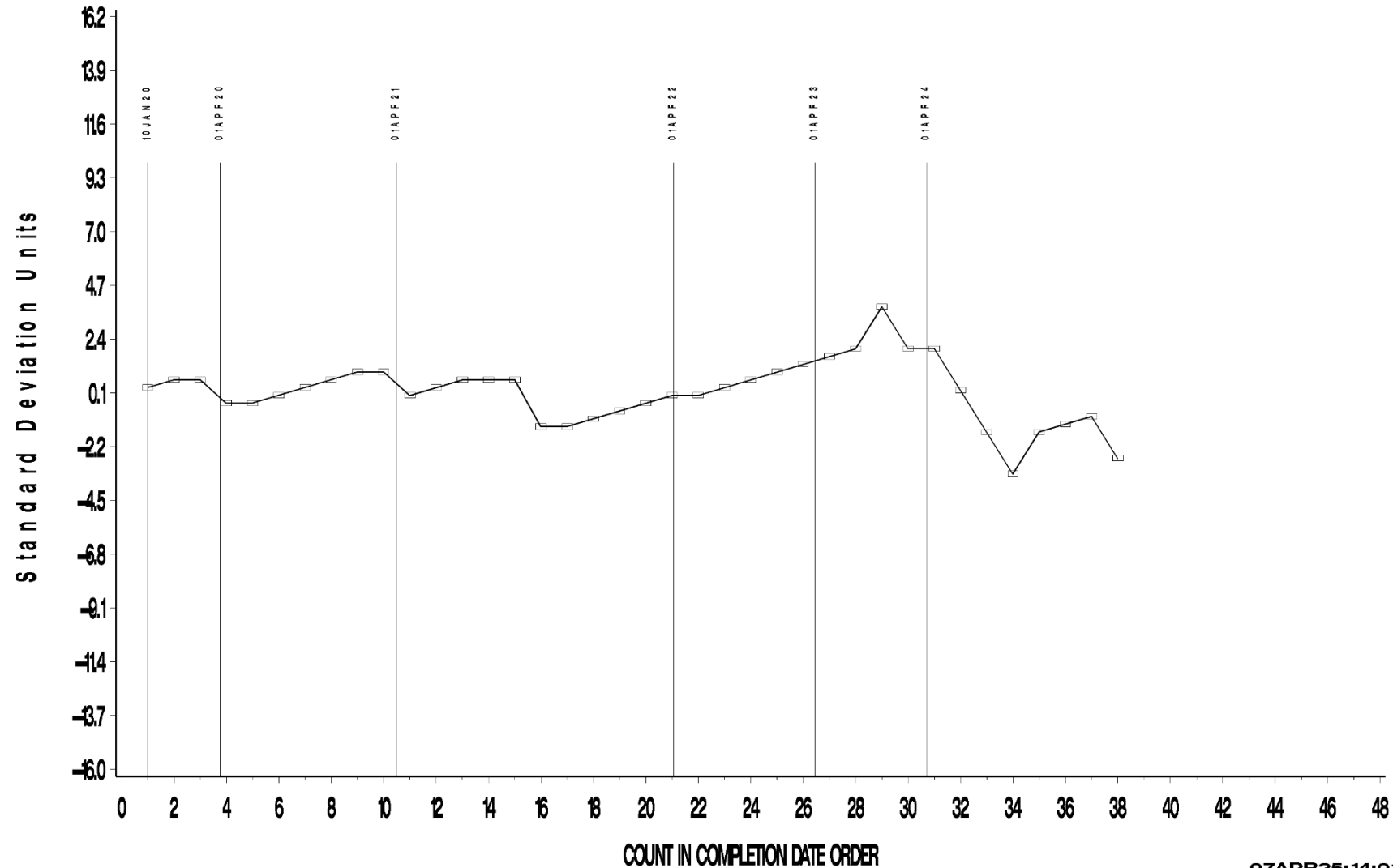
Results for 155-1 are not included in this SPIT chart due to its current targets yielding undefined calculations.

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FINAL PINION GEAR PITTING/SPALLING

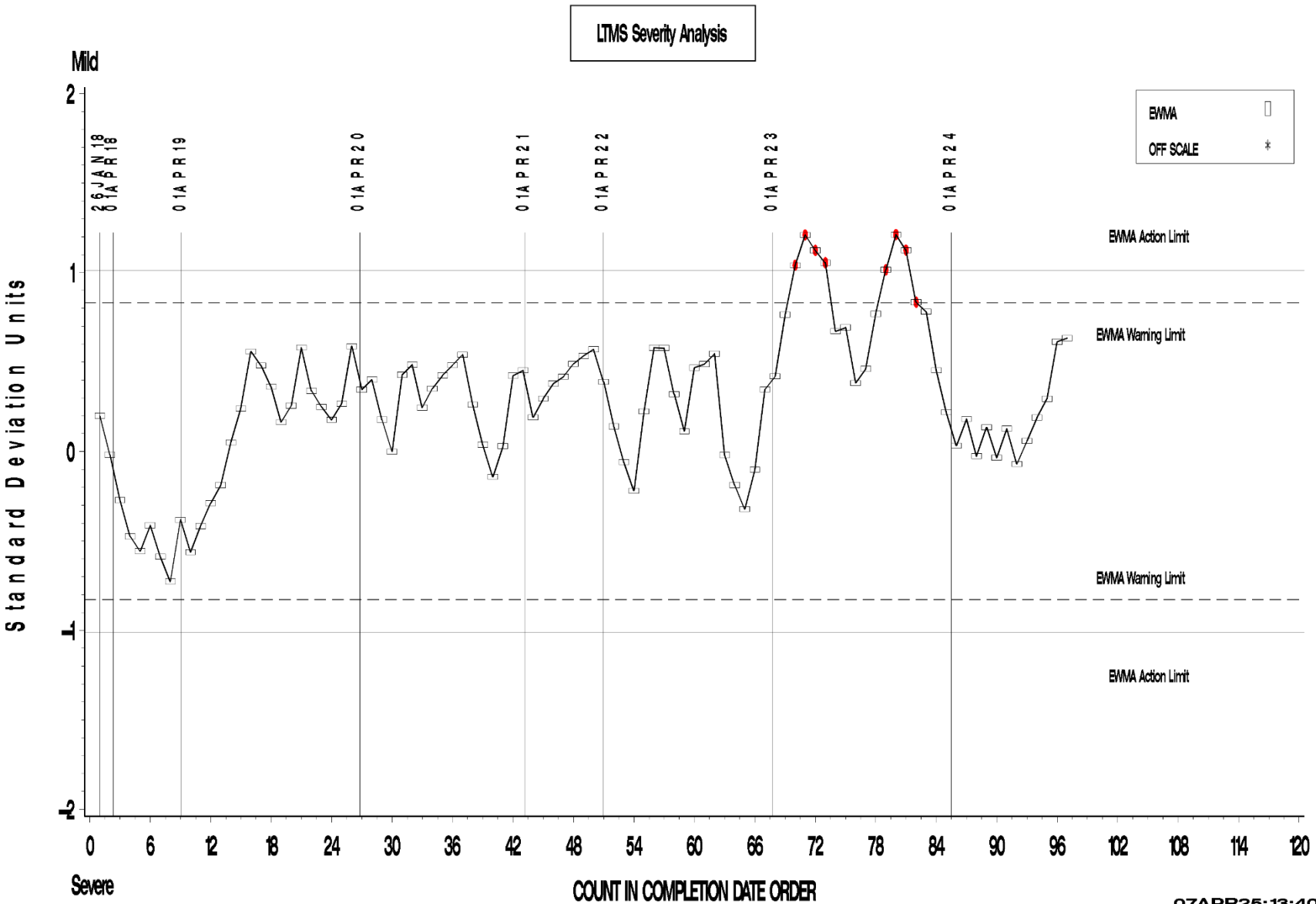


CUSUM Severity Analysis

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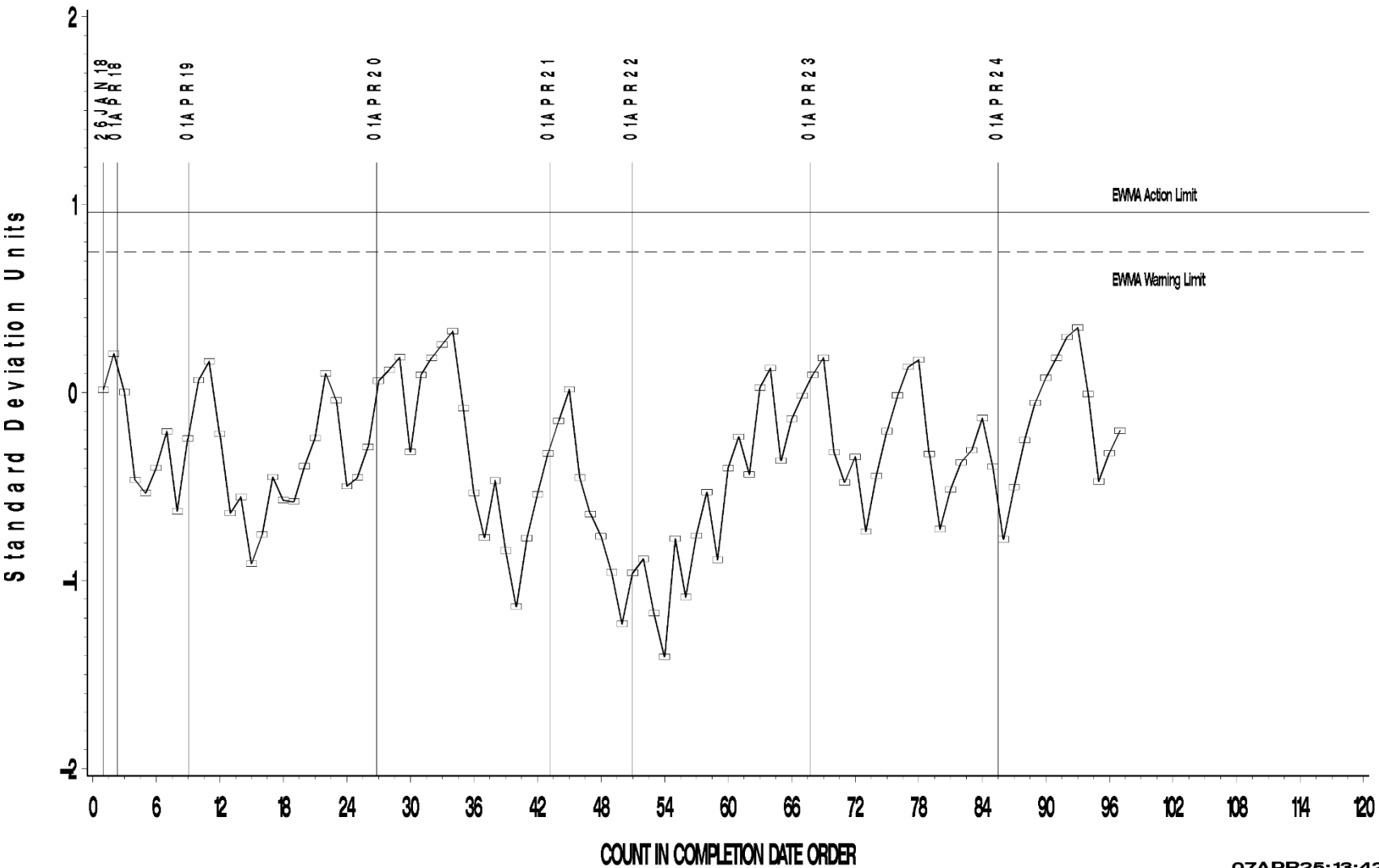


FINAL PINION GEAR WEAR



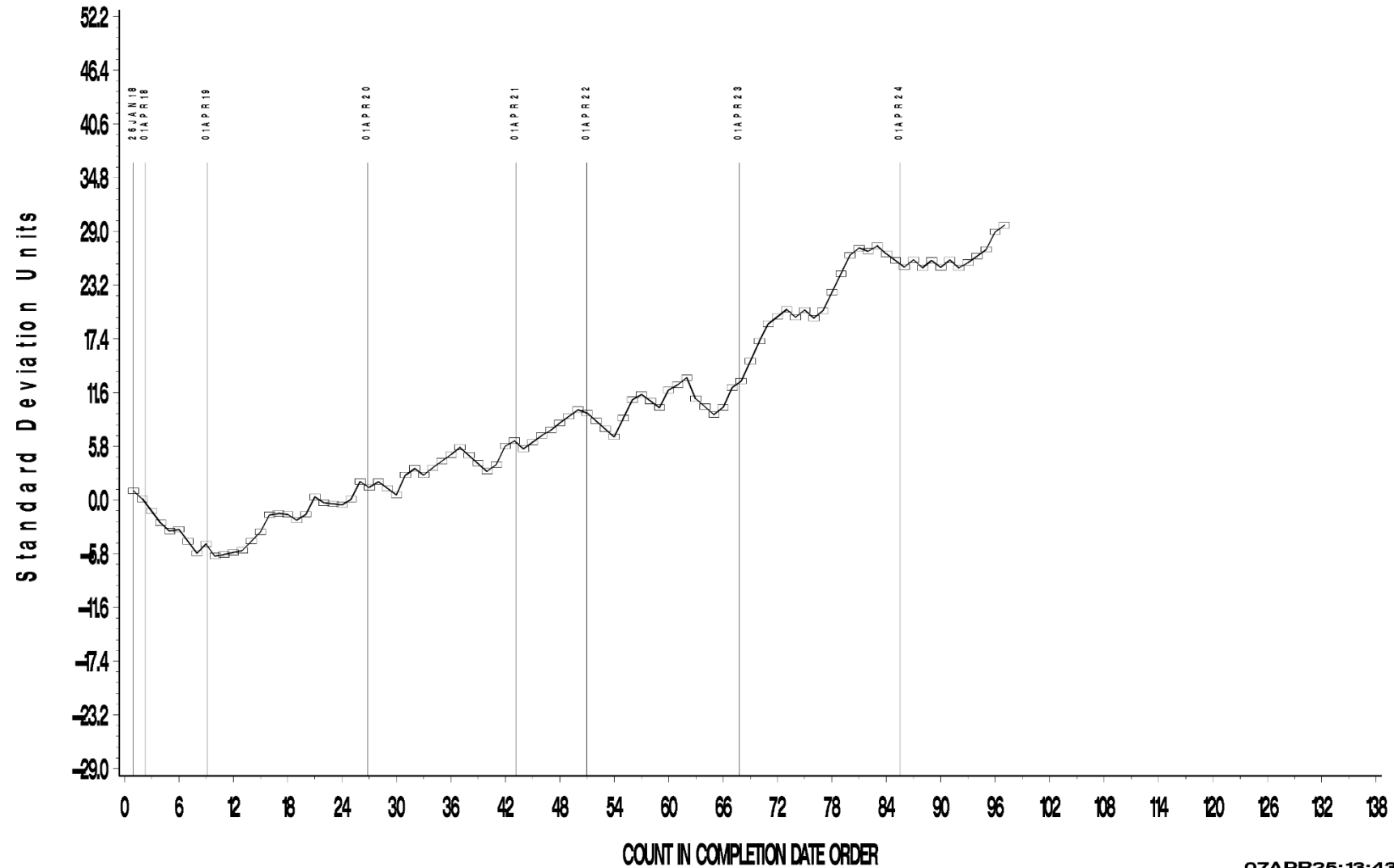
FINAL PINION GEAR WEAR

LTMS Precision Analysis



FINAL PINION GEAR WEAR

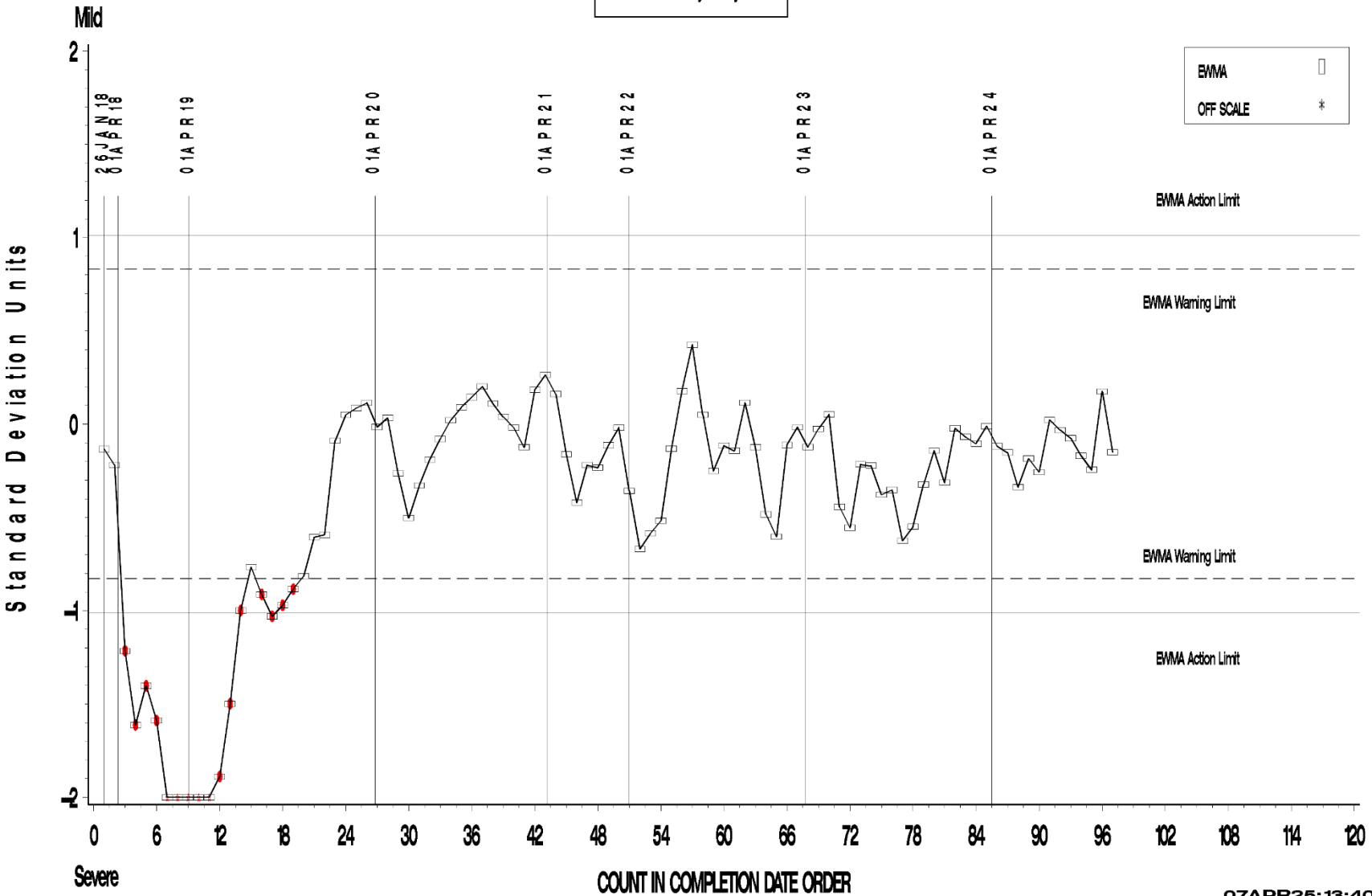
CUSUM Severity Analysis





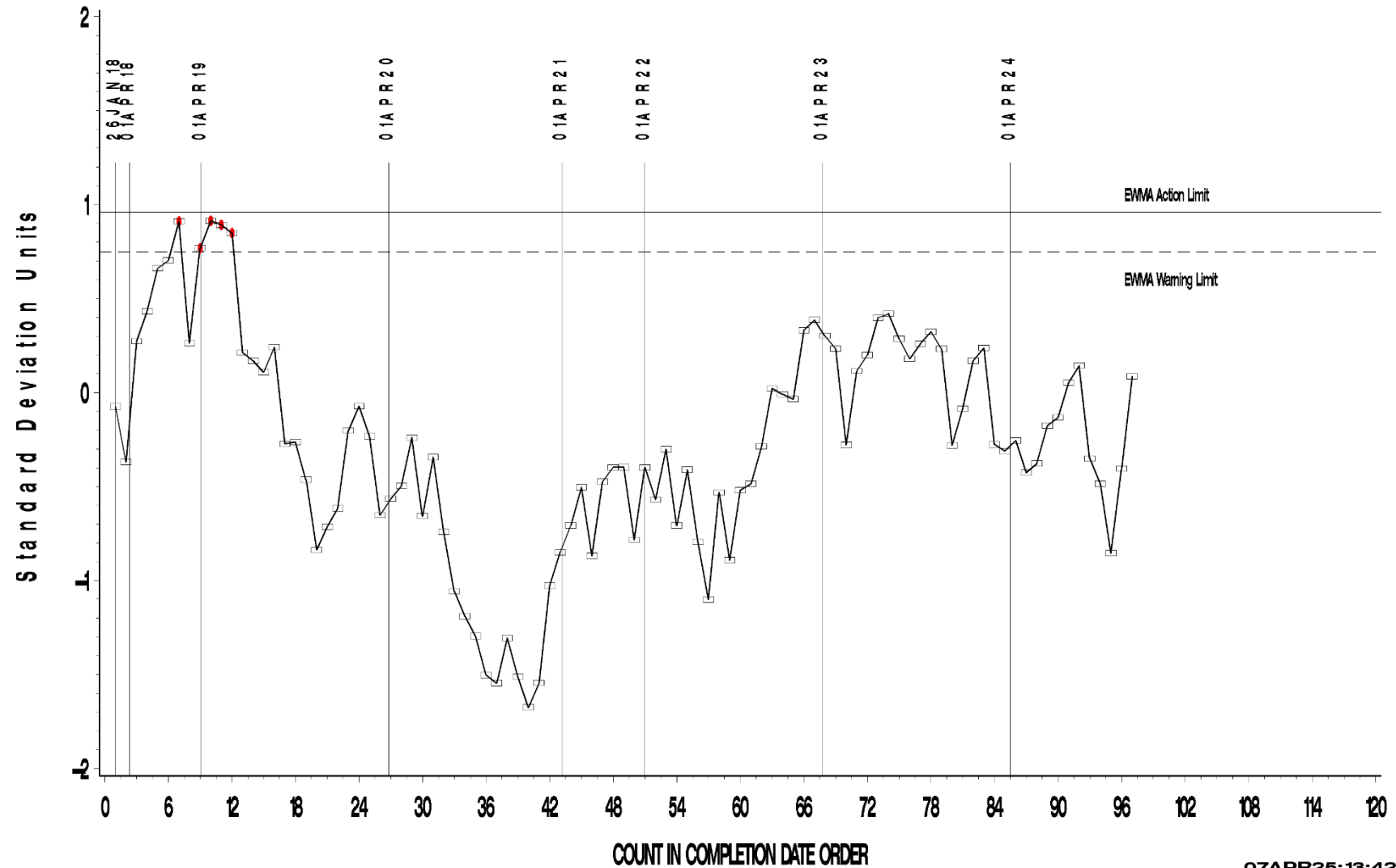
FINAL PINION GEAR RIPPLING

LTMS Severity Analysis



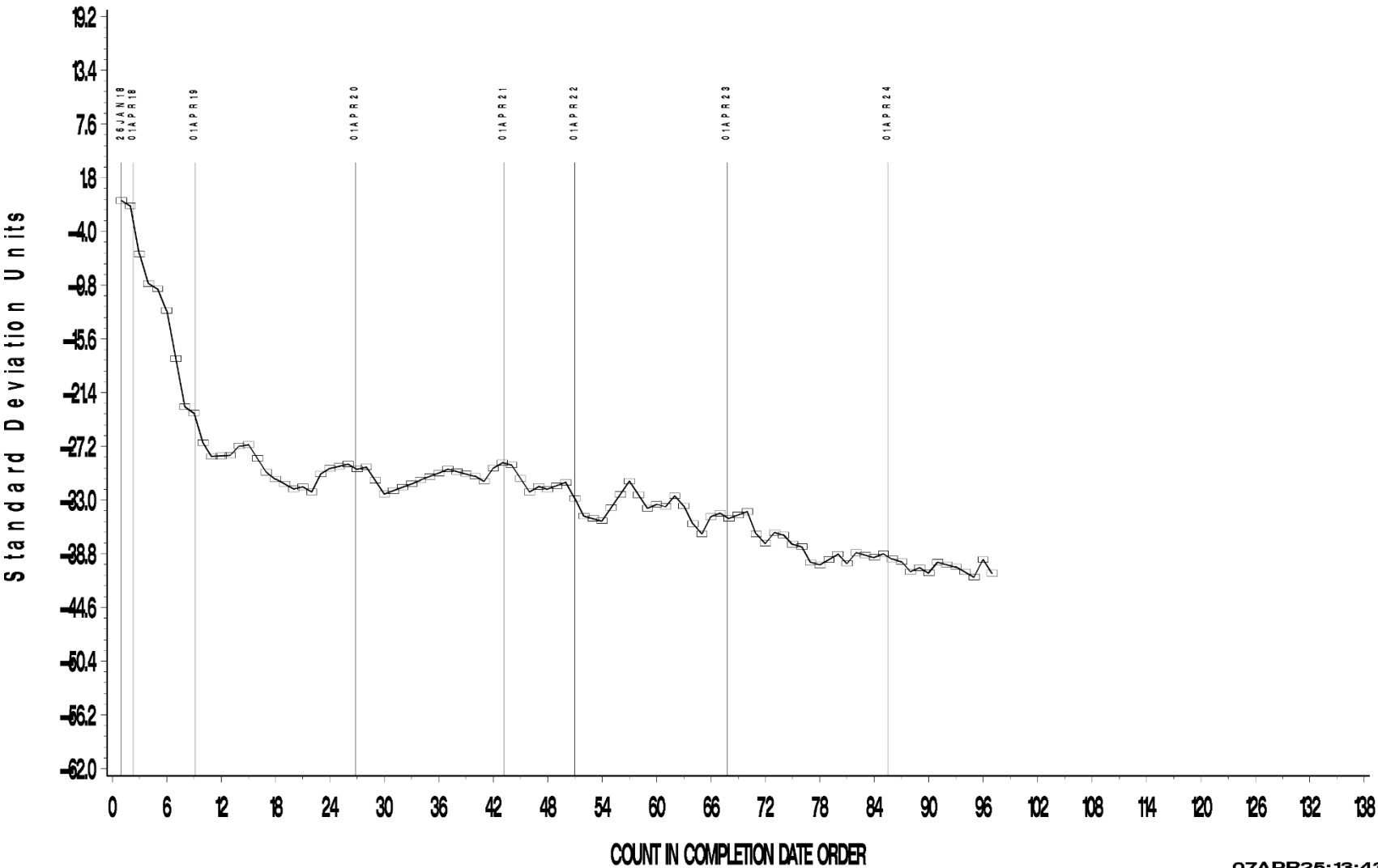
FINAL PINION GEAR RIPPLING

LTMS Precision Analysis

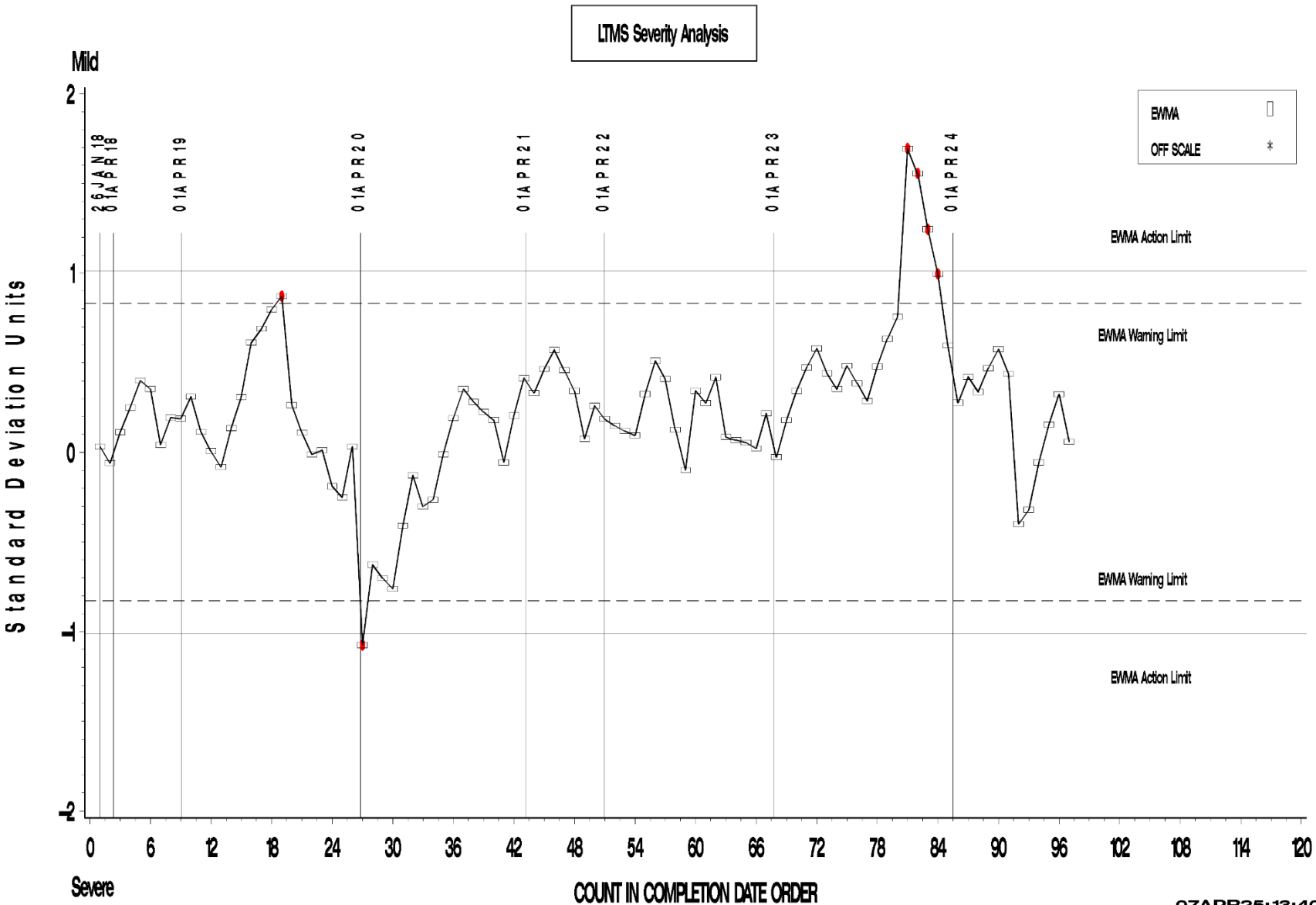


FINAL PINION GEAR RIPPLING

CUSUM Severity Analysis

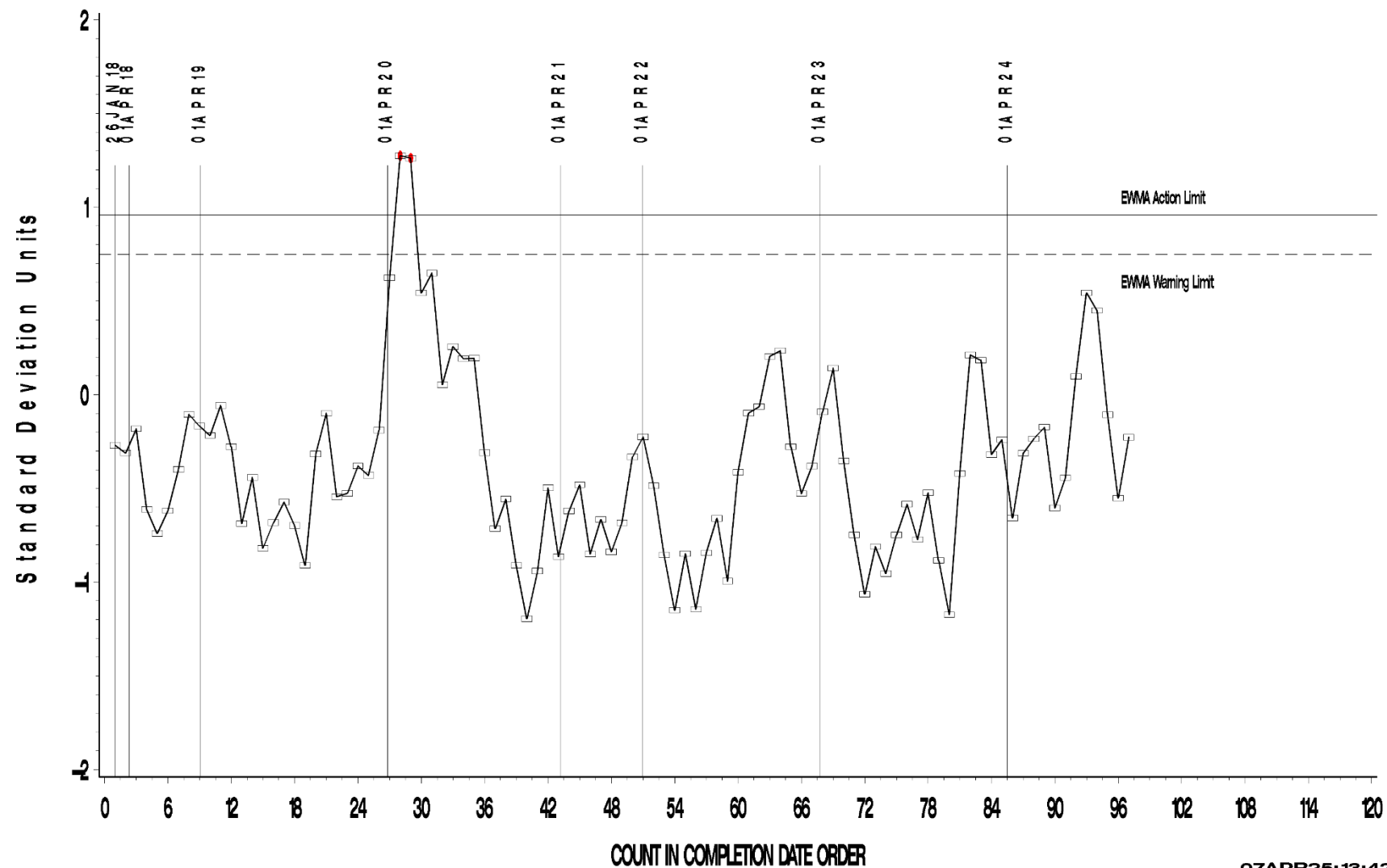


FINAL PINION GEAR RIDGING



FINAL PINION GEAR RIDGING

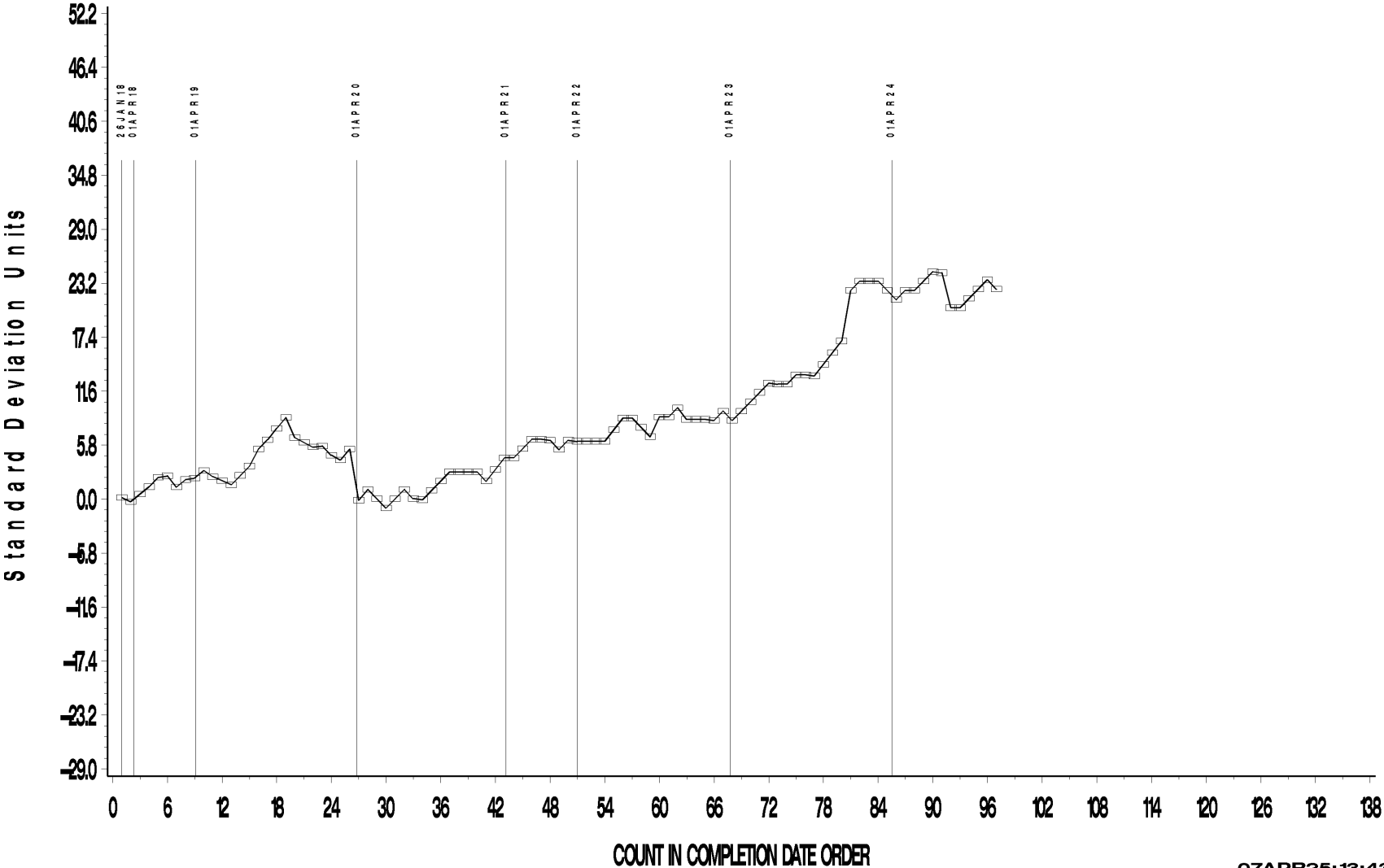
LTMS Precision Analysis



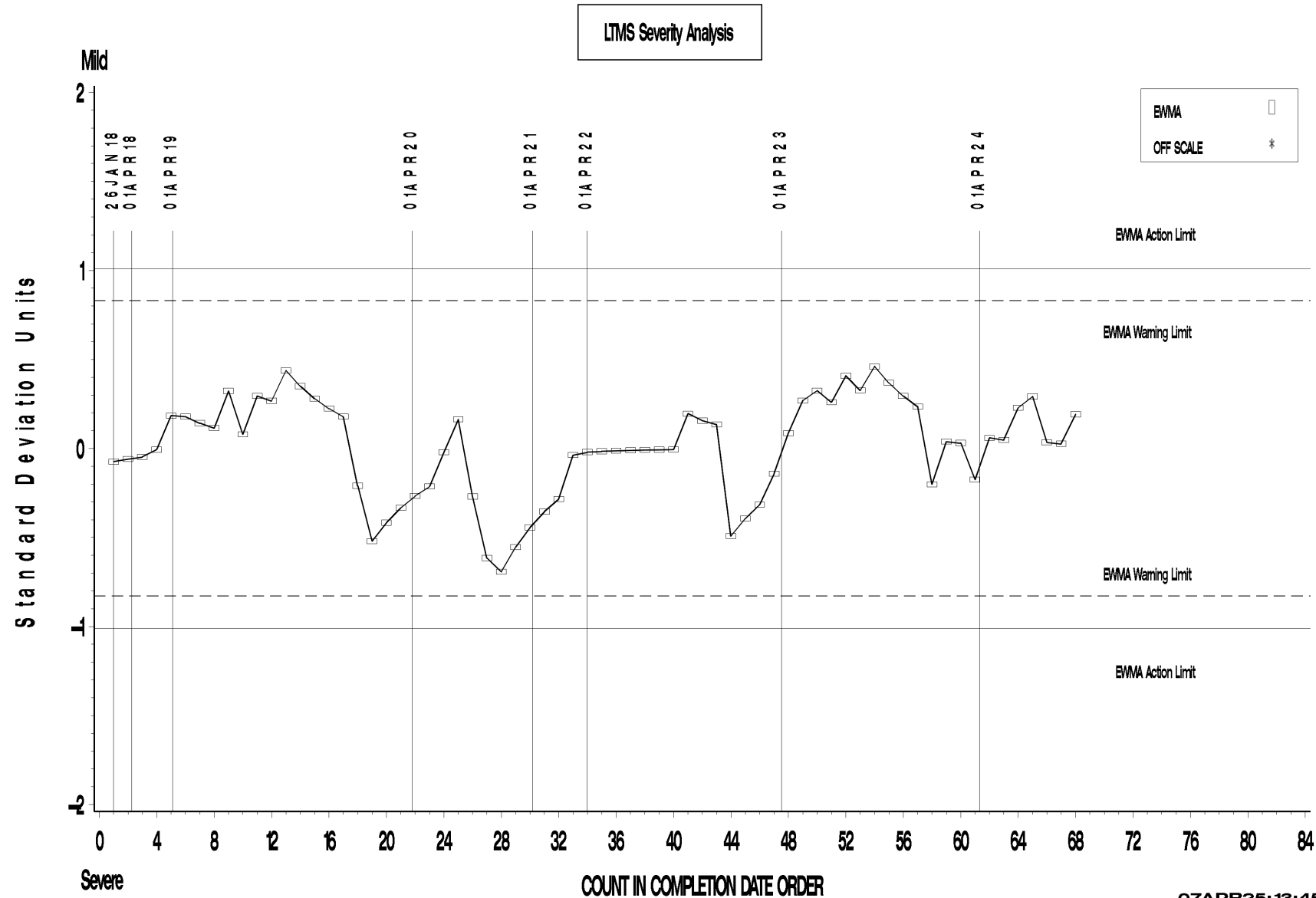


FINAL PINION GEAR RIDGING

CUSUM Severity Analysis



L-37-1 UNCOATED INDUSTRY OPERATIONALLY VALID DATA
IND not = '155-1
FINAL PINION GEAR PITTING/SPALLING



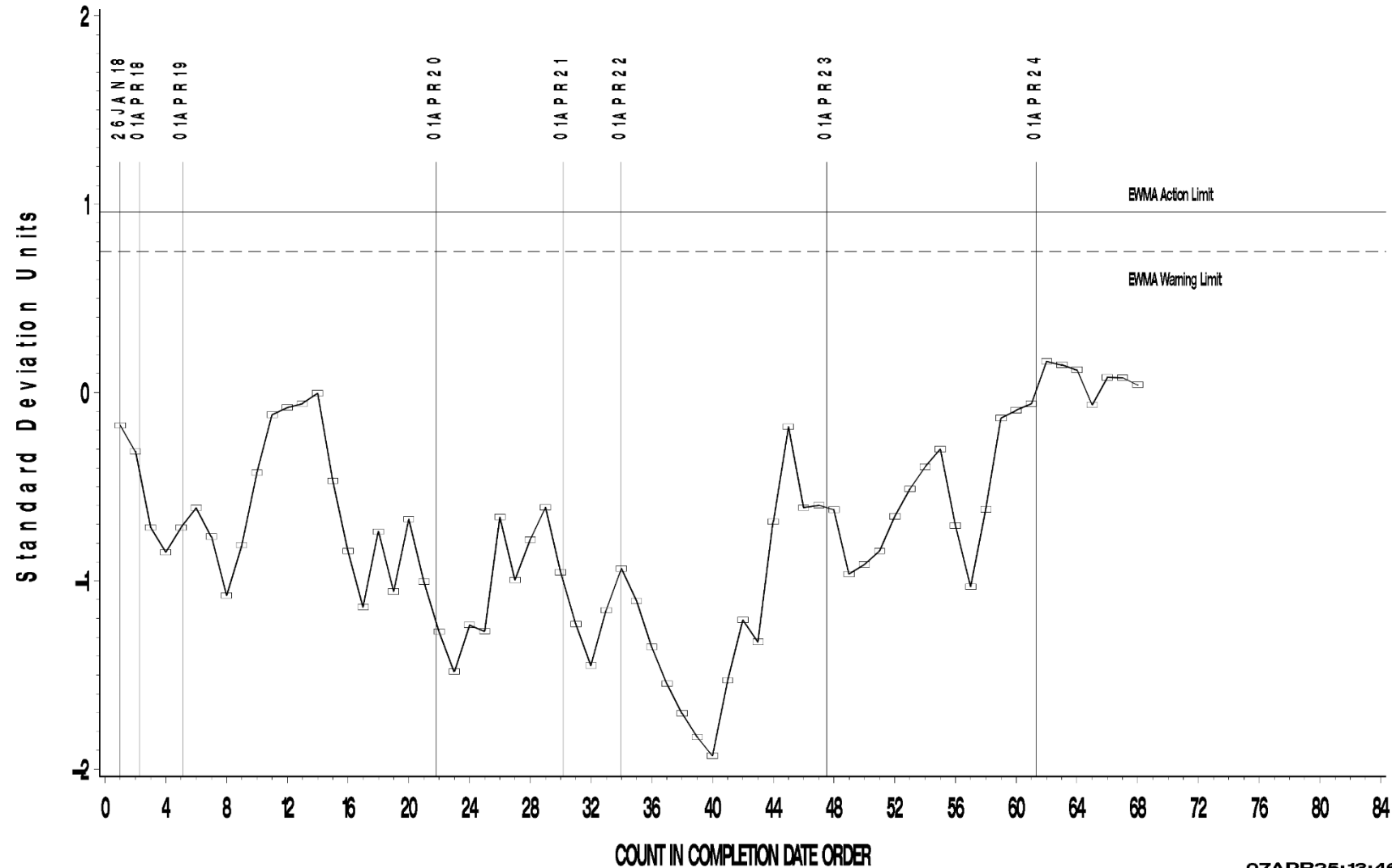
Results for 155-1 are not included in this SPIT chart due to its current targets yielding undefined calculations.

L-37-1 UNCOATED INDUSTRY OPERATIONALLY VALID DATA
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FINAL PINION GEAR PITTING/SPALLING



LTMS Precision Analysis

Results for 155-1 are not included in this SPIT chart due to its current targets yielding undefined calculations.

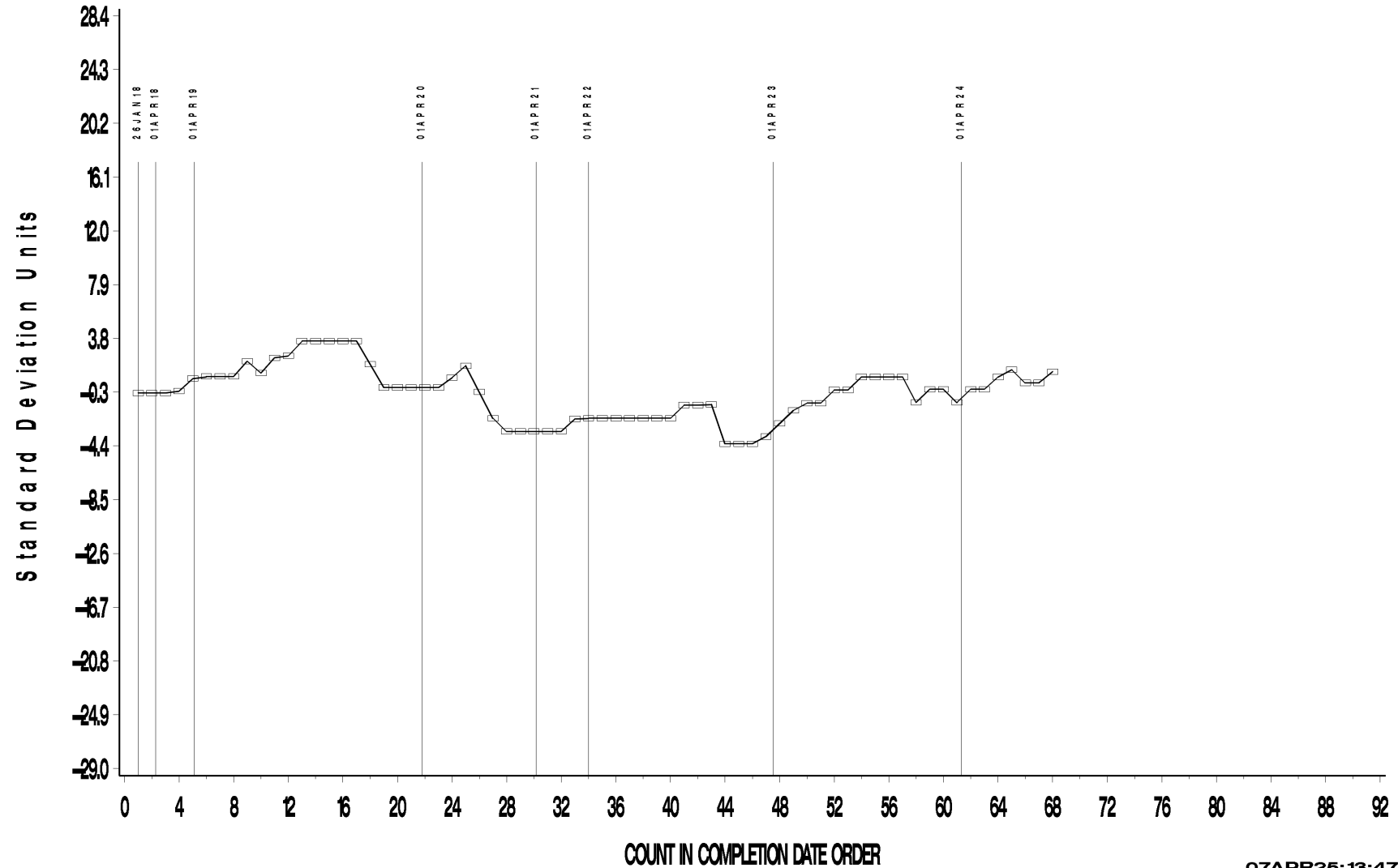


L-37-1 UNCOATED INDUSTRY OPERATIONALLY VALID DATA
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FINAL PINION GEAR PITTING/SPALLING

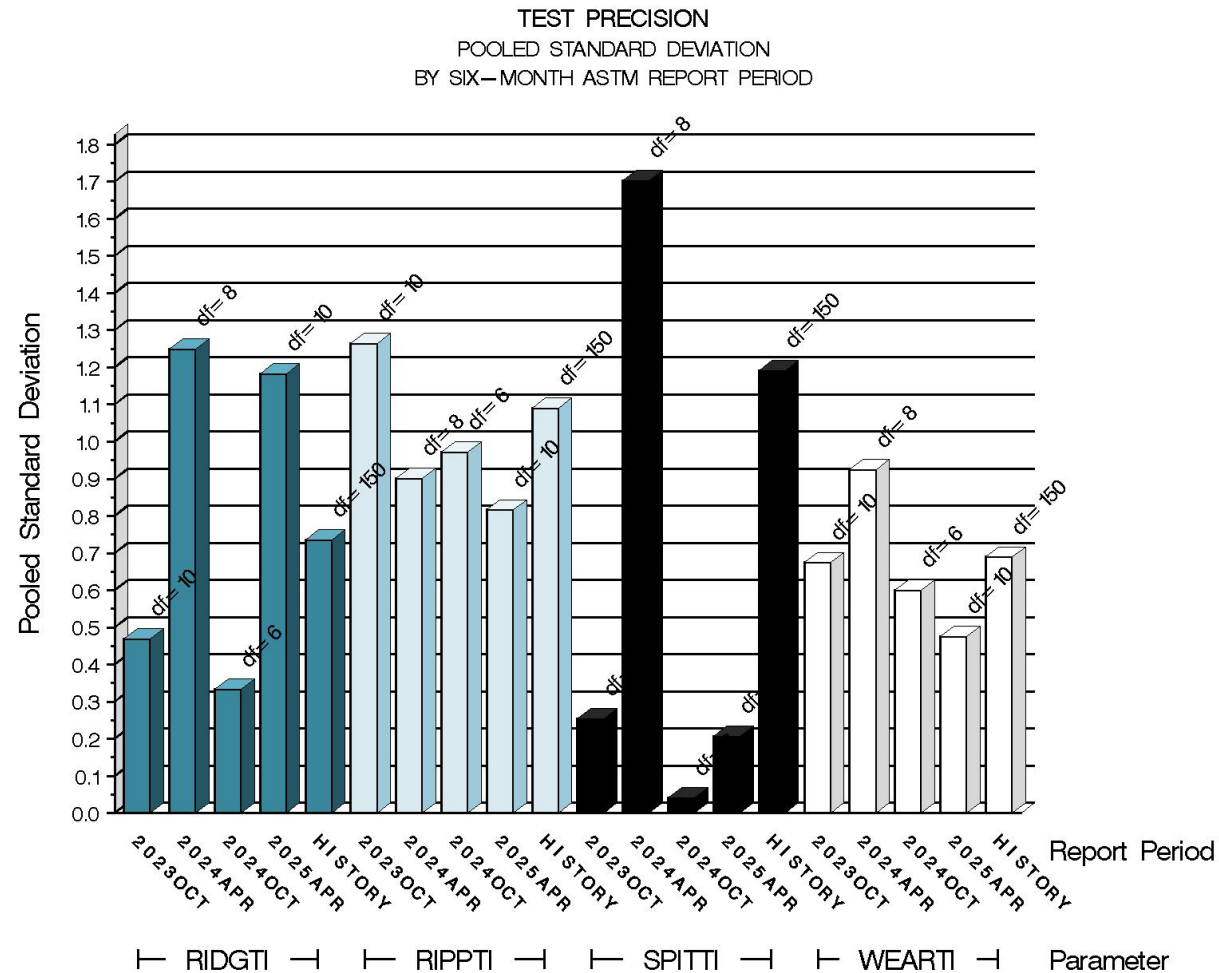


CUSUM Severity Analysis

Results for 155-1 are not included in this SPIT chart due to its current targets yielding undefined calculations.



L-37-1 Test Precision



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L-42

➤➤ April 2025

L-42 Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	10
Unacceptable Calibration Test	OC	2
Operationally Invalid Calibration Test	LC	1
Acceptable Discrimination Run	AS	3
Total		16

L-42 Failed Tests

Test Status	Validity Code	#
Failed Calibration Test (Severe Scoring)	OC	2
Total		2

L-42 Lost Tests

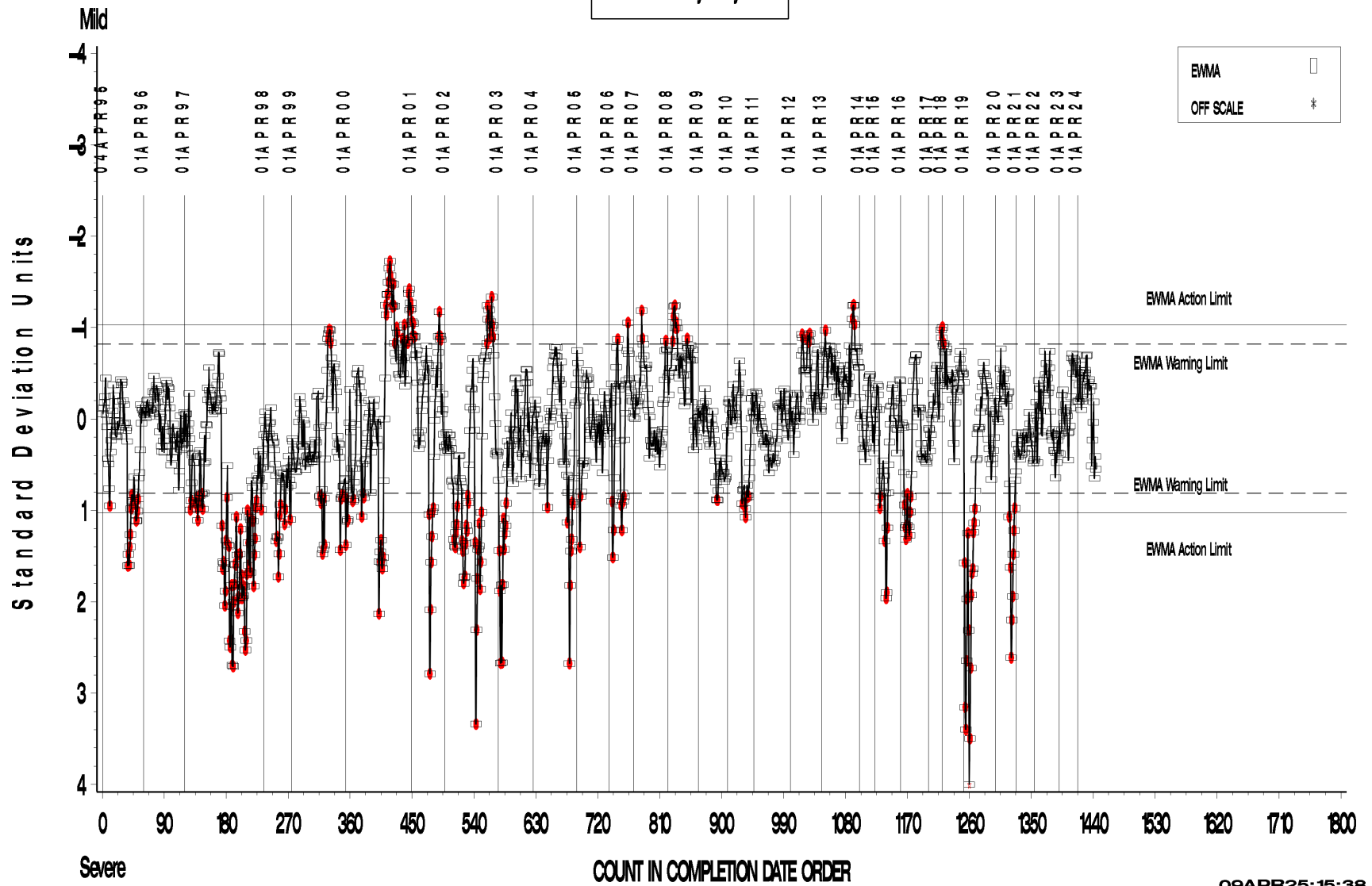
Test Status	Validity Code	#
Aborted Calibration Test (Oil Temp Out of Spec)	LC	1
Total		1

L-42 Summary of Severity & Precision

Severity
Pinion scoring remained within the limits this period.
Precision
Pinion scoring ended the period exceeding the action limit.

FINAL EOT PINION SCORING COAST SIDE

LTMS Severity Analysis

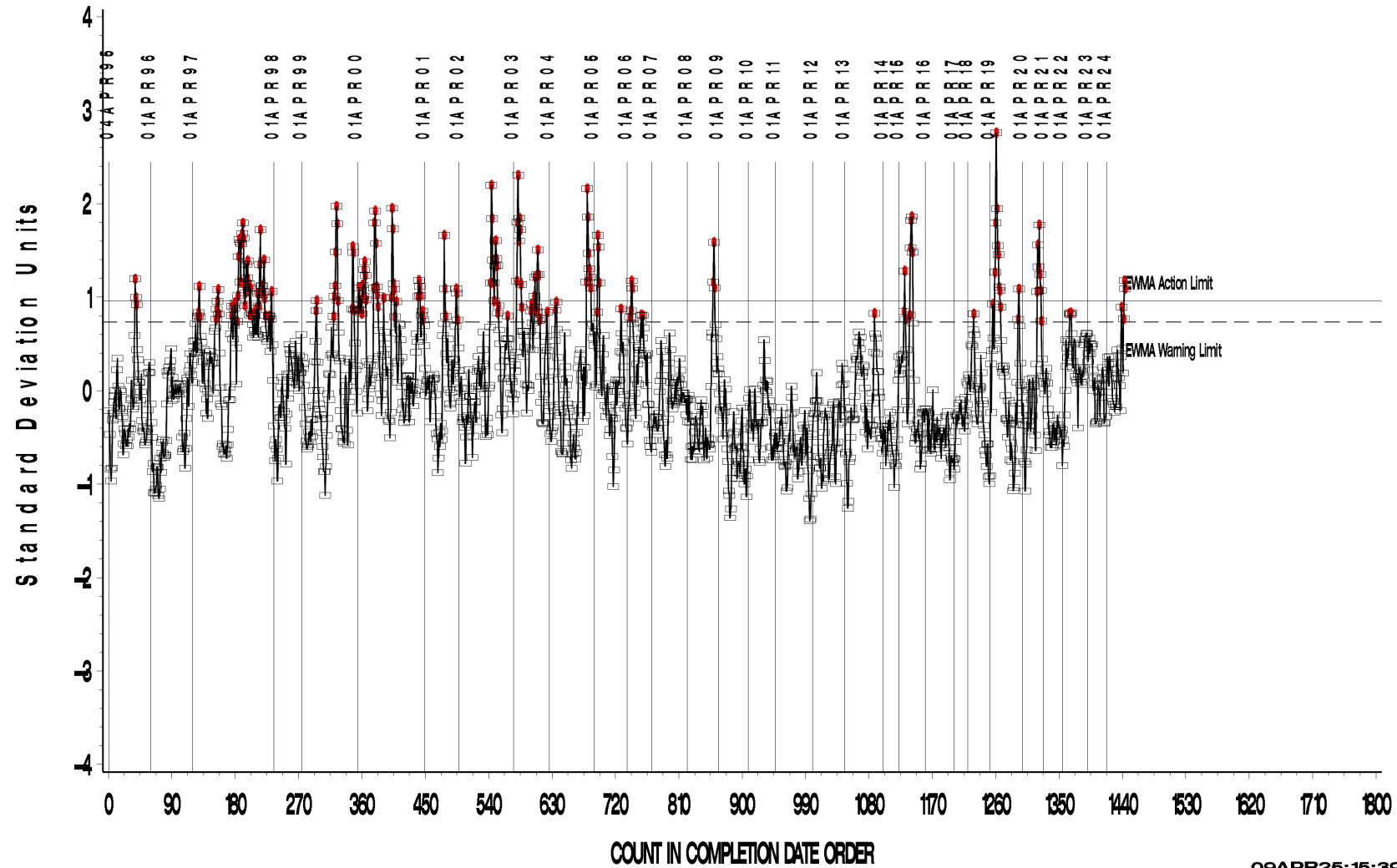


L-42 INDUSTRY OPERATIONALLY VALID DATA



FINAL EOT PINION SCORING COAST SIDE

LTMS Precision Analysis



FINAL EOT PINION SCORING COAST SIDE

CUSUM Severity Analysis



L-42 Test Precision

		Pooled Standard Deviation			
Lab	Coast Side Pinion Scoring Δ/s	df	Coast Side Pinion Scoring	Coast Side Ring Scoring	Shock Series I Coast Side Ring Scoring
A	1.09	4	14.65	12.99	12.45
B	-0.73	0	0.00	0.00	0.00
D	-0.04	4	3.83	5.20	0.00
G	-1.09	0	0.00	0.00	0.00

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HTCT

»» April 2025

HTCT Activity

- No HTCT test activity this reporting period.

OSCT

➤➤ April 2025

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OSCT Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	31
Unacceptable Calibration Test	OC	3
Unacceptable Info Run (Elastomer Approval)	MI	1
Acceptable Info Run (Elastomer Approval)	NI	28
Total		63

OSCT – Failed Tests

Test Status	Validity Code	#
Unacceptable Calibration Test (Pela low of target)	OC	1
Unacceptable Cal Test (Pela high of target)	OC	2
Unacceptable Info Run (Pela high of target, pvca low of target)	MI	1
Total		4

OSCT – Lost Tests

Test Status	Validity Code	#
No lost tests this period		
Total		0

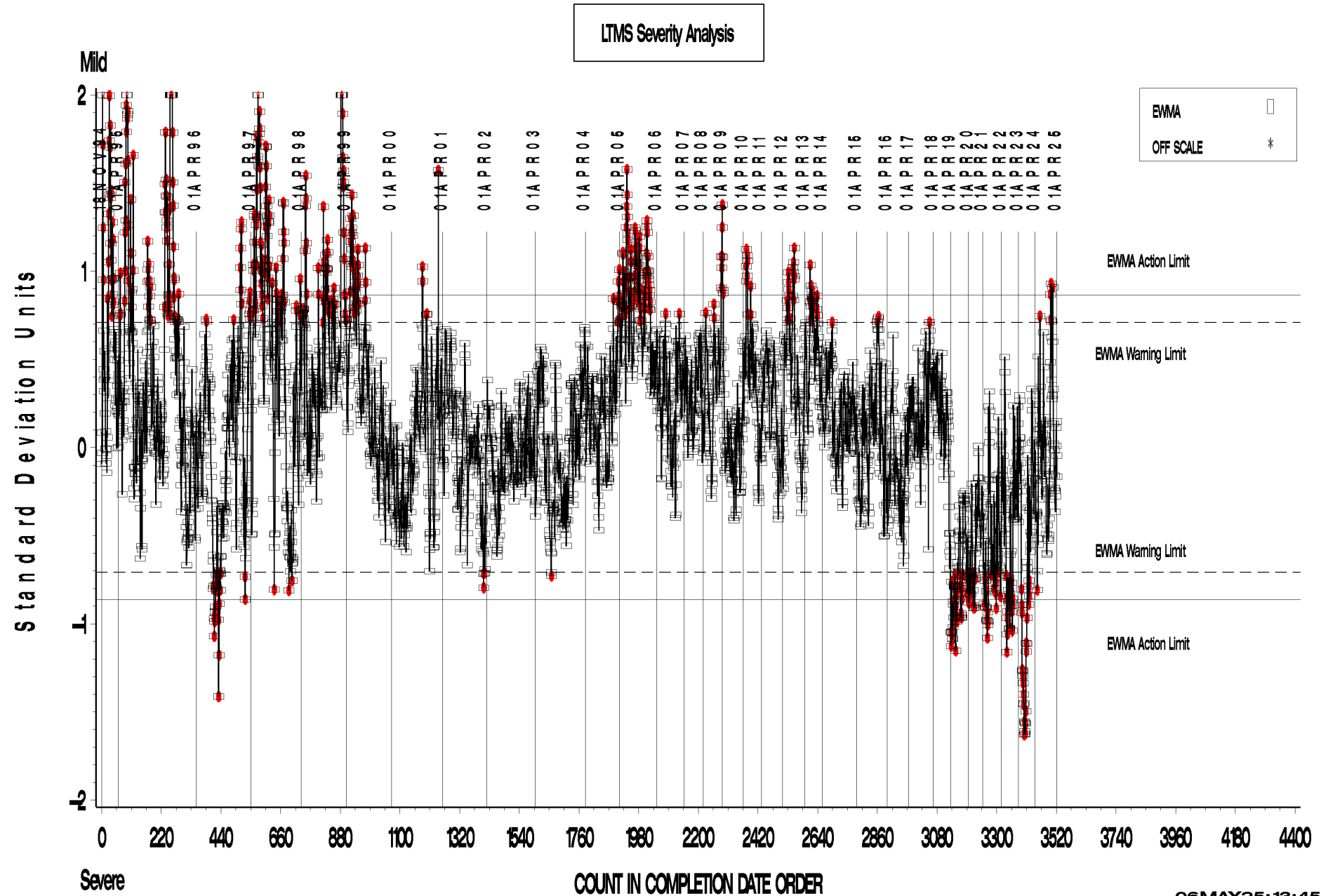
OSCT Test Severity

- **Severity:**
 - The combined elastomer plots show that PELA exceeded the EWMA action limit in the severe direction this reporting period but finished the period within the limits.
 - The individual elastomer plots showed that FL SAHA exceeded the action limit during this reporting period but finished within the limits.
 - NI SAHA and NI PELA both remain outside of the action limits.

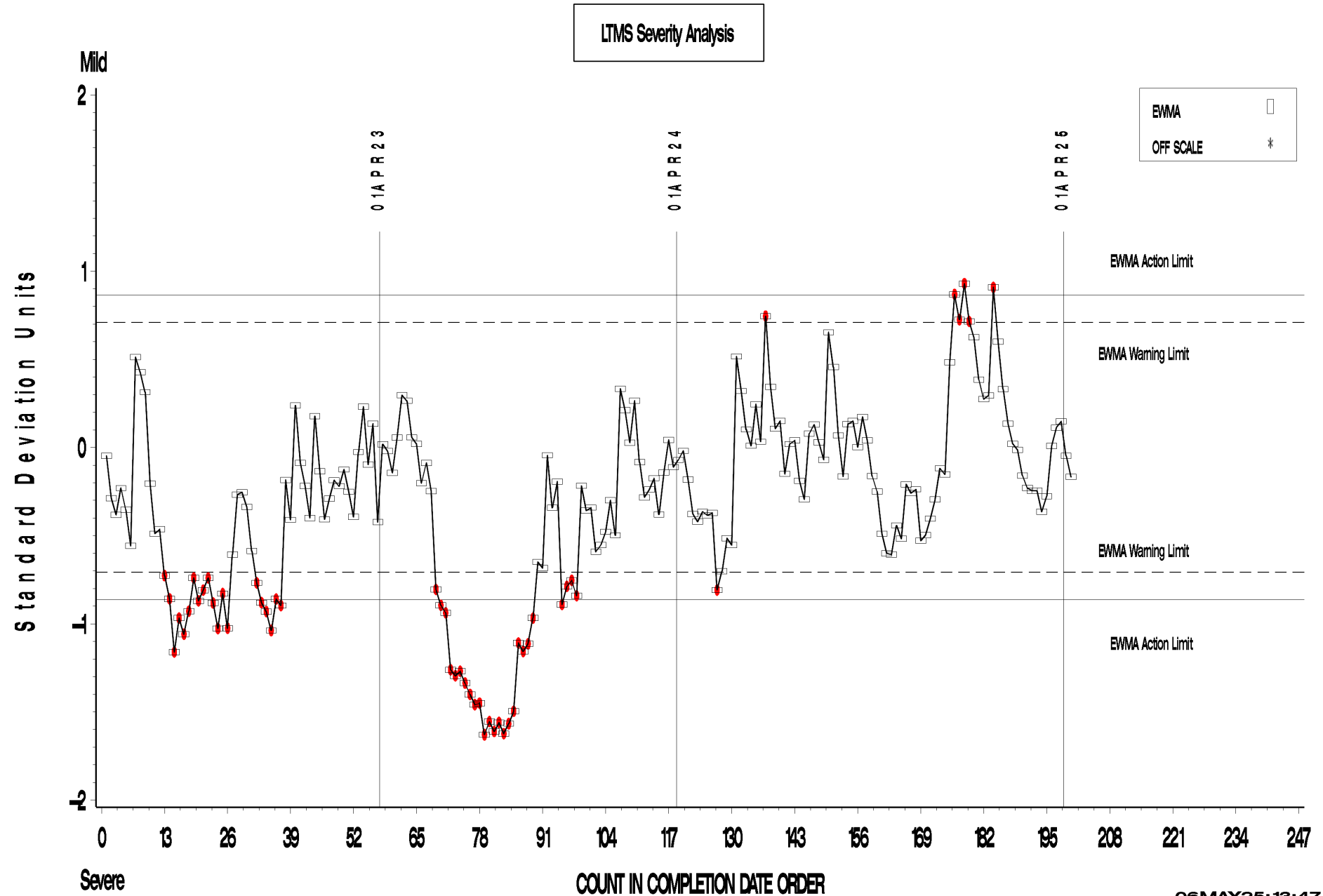
OSCT Test Severity

- Precision:
 - The combined elastomer plots showed that the precision for PELA exceeded the action limit during this reporting period but ended the period within the limits.

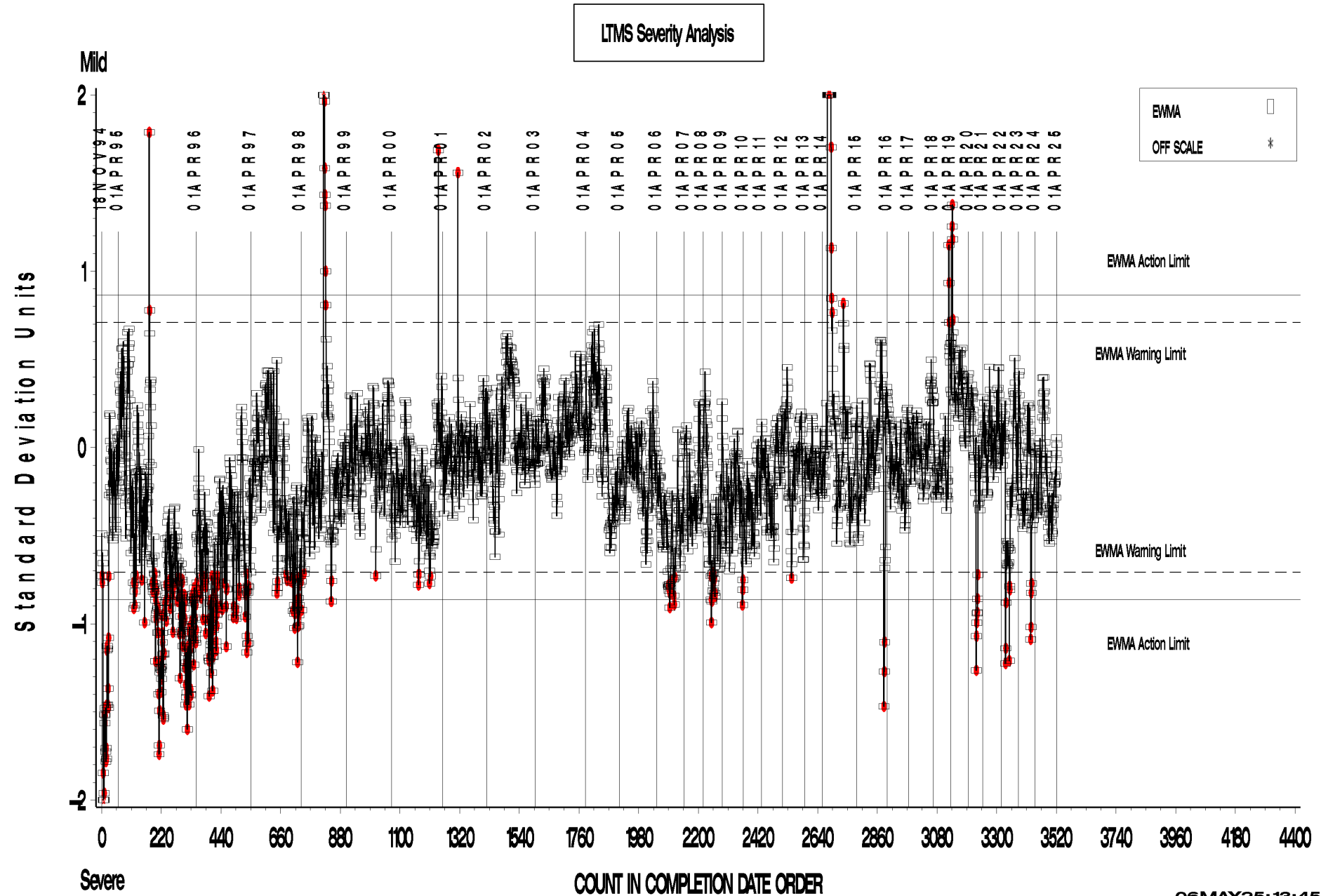
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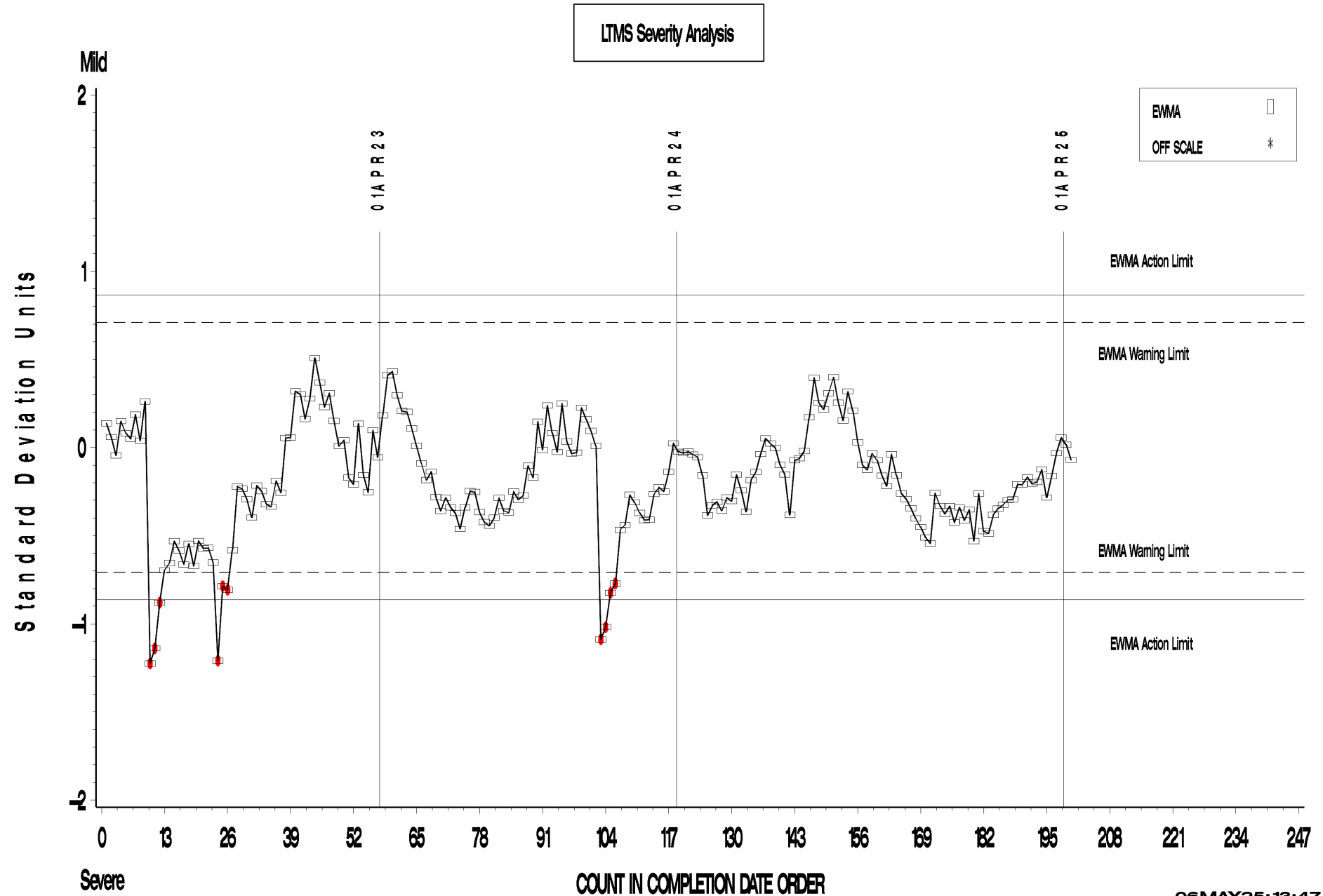
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REF. PERCENT VOLUME CHANGE AVG.

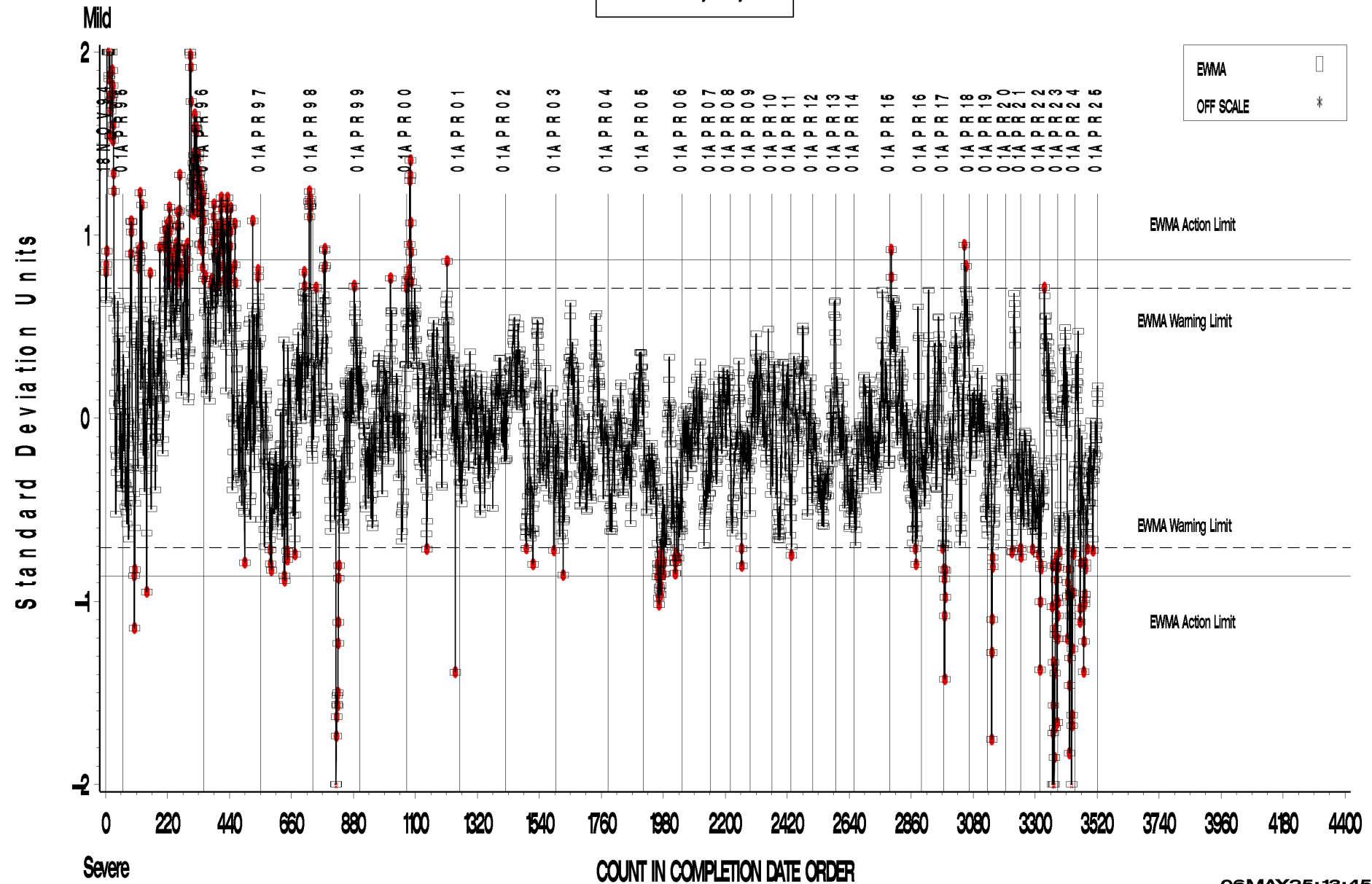


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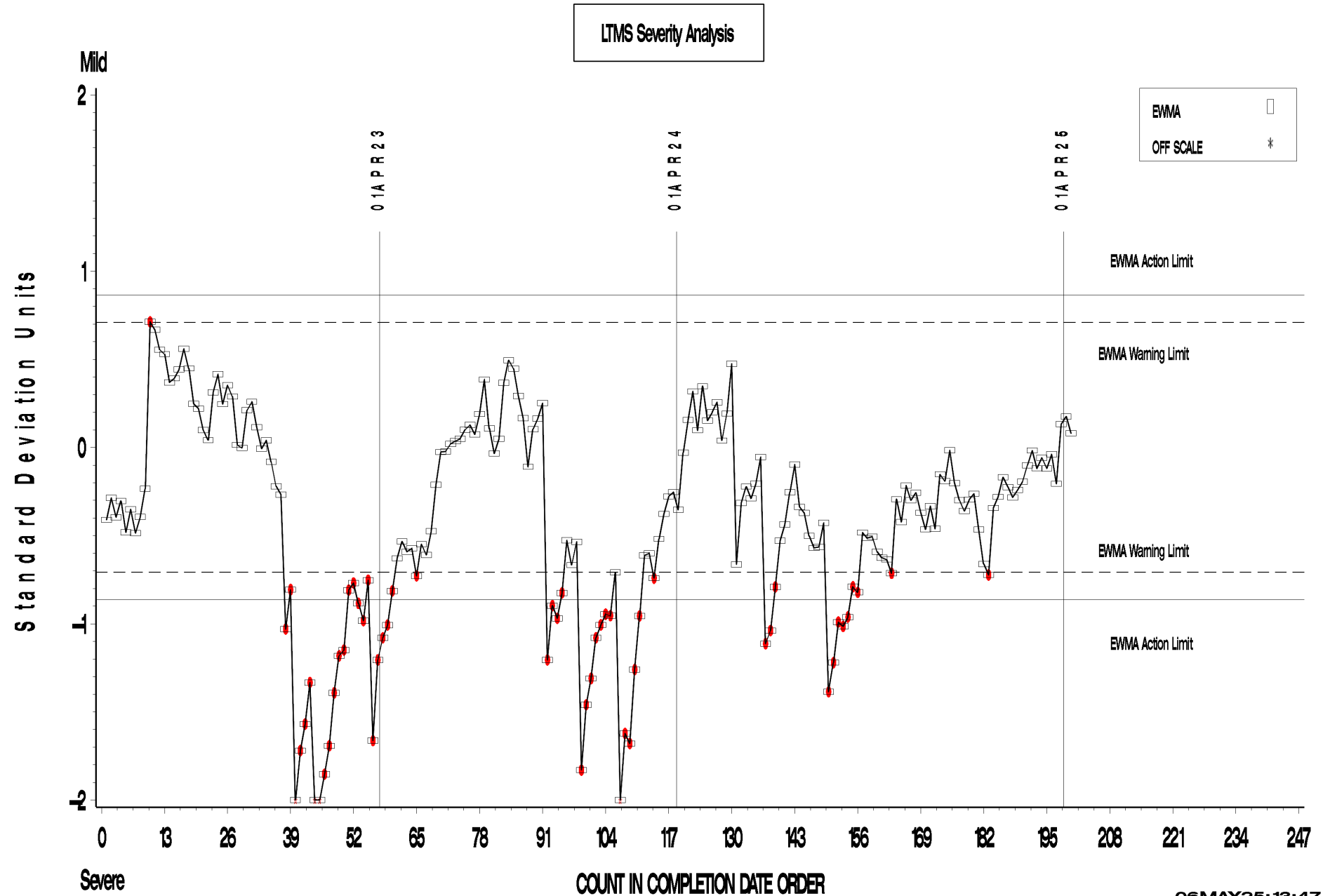


REF. SHORE A HARDNESS CHANGE AVG.

LTMS Severity Analysis



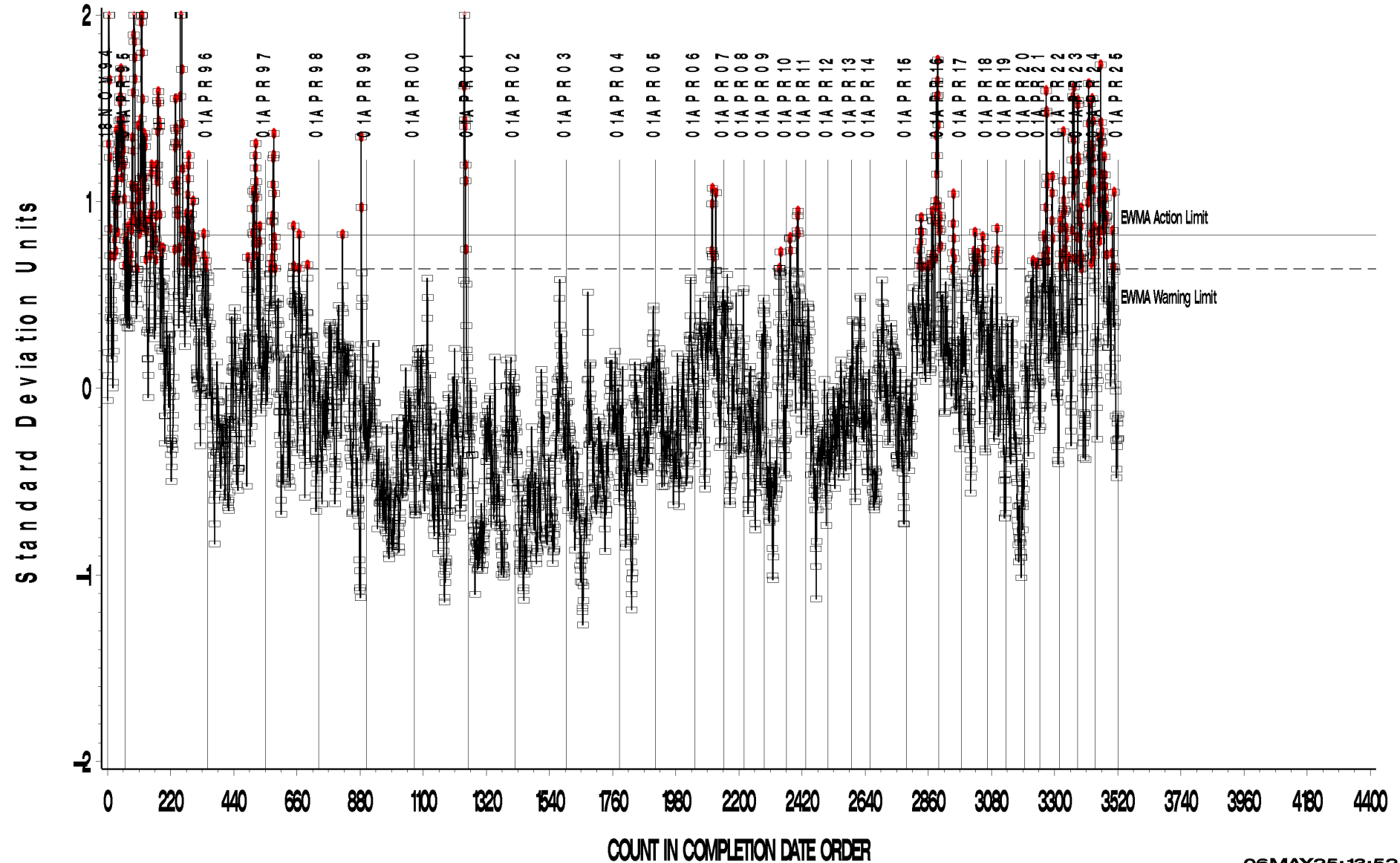
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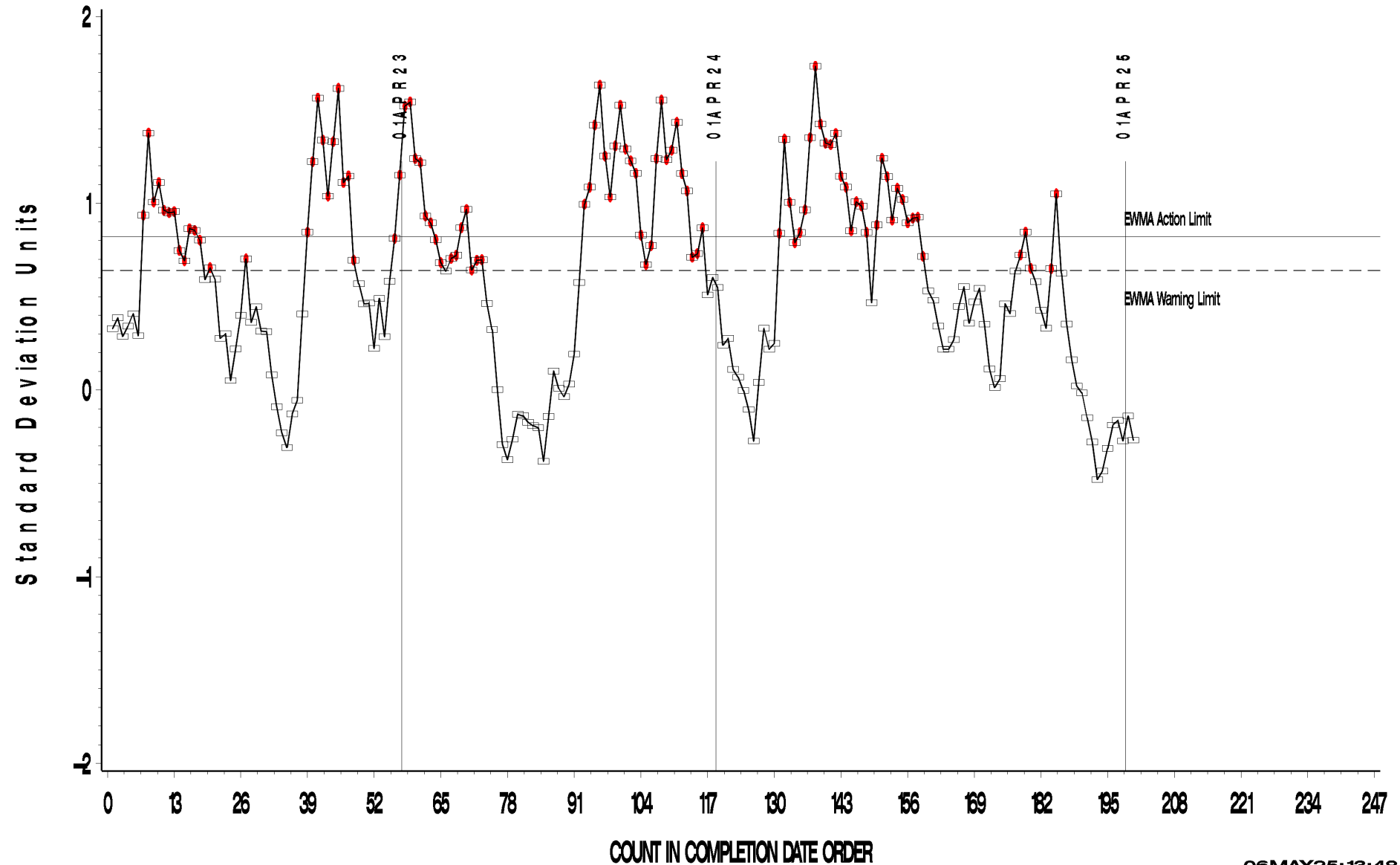
LTMS Precision Analysis



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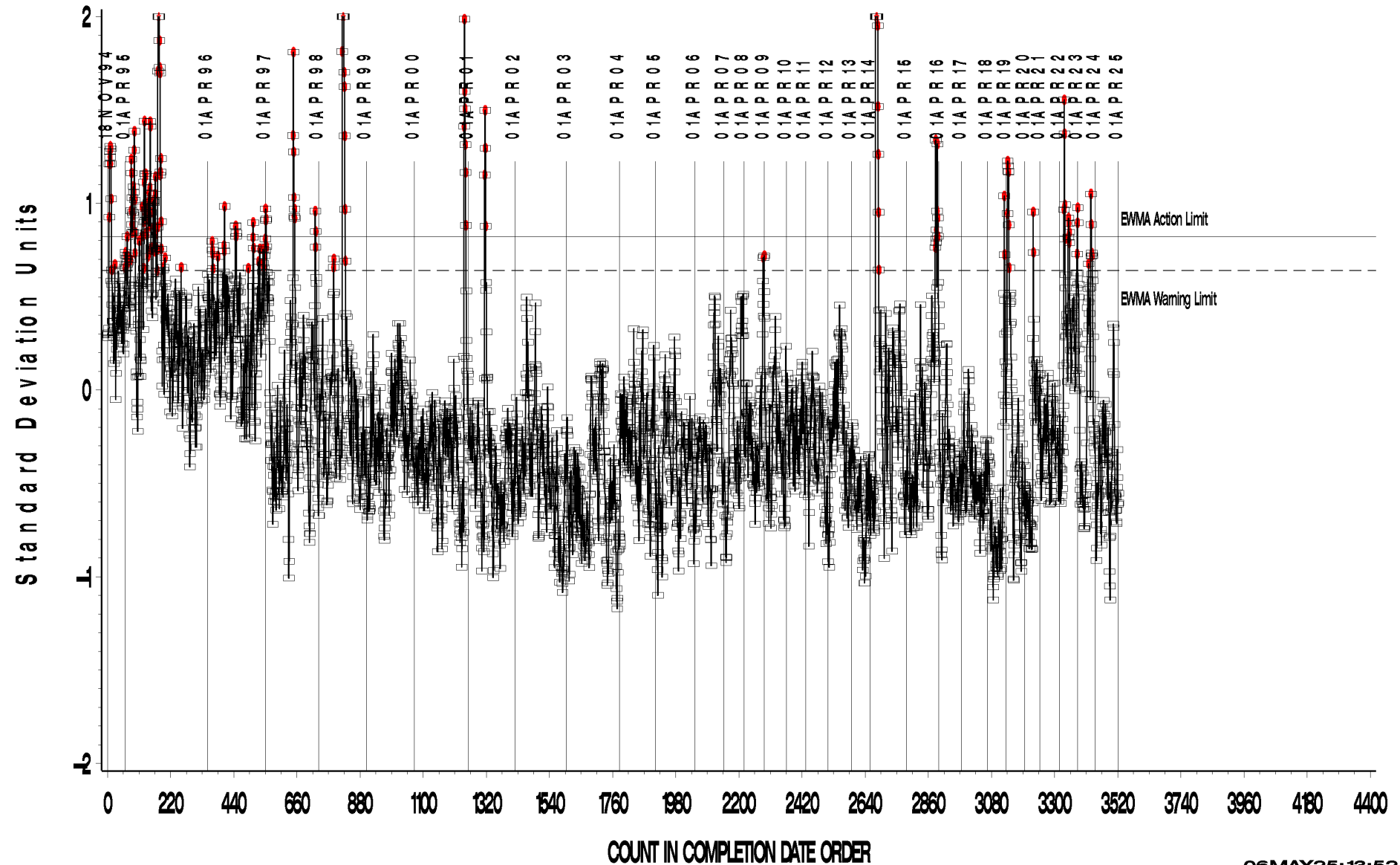
LTMS Precision Analysis



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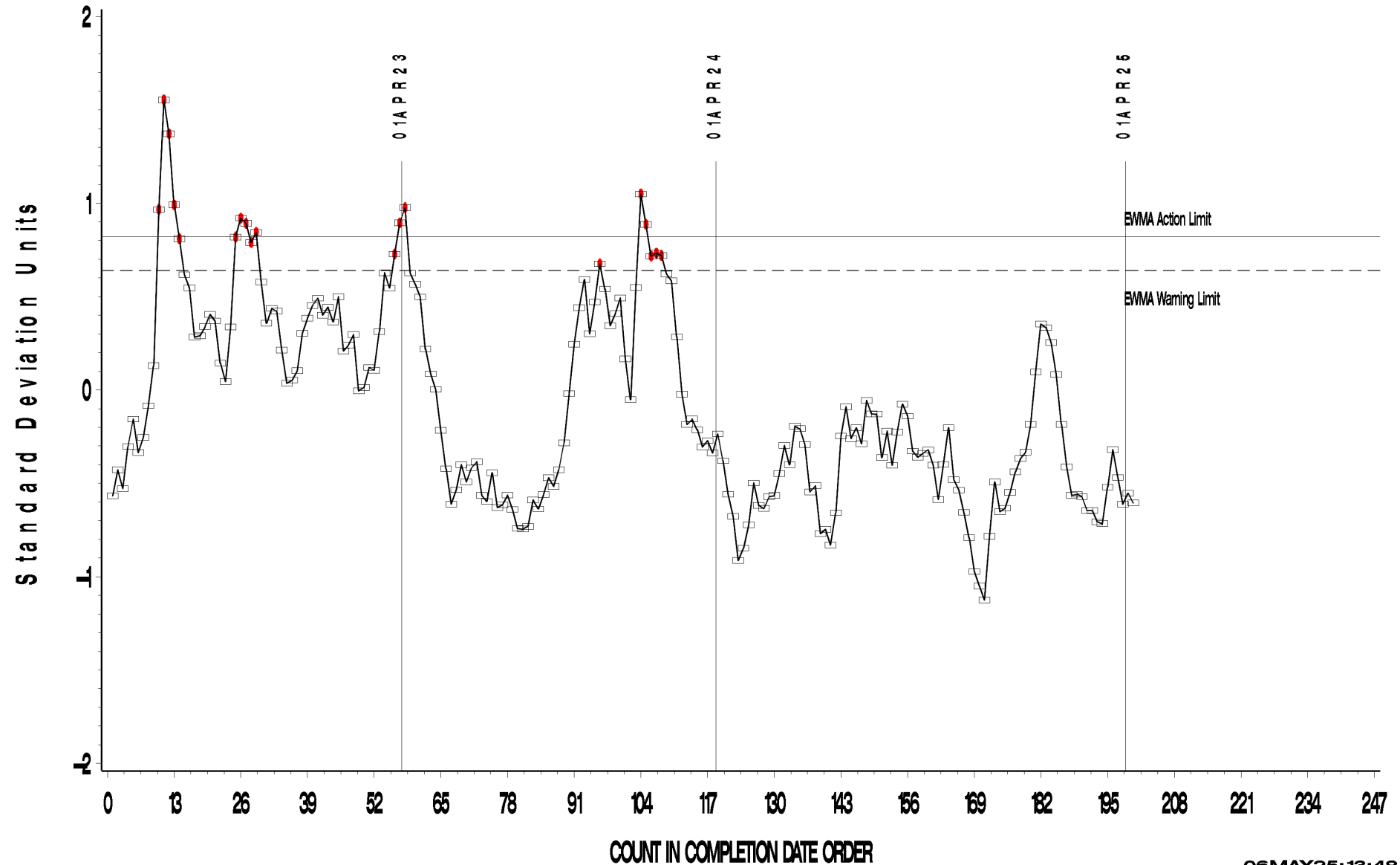
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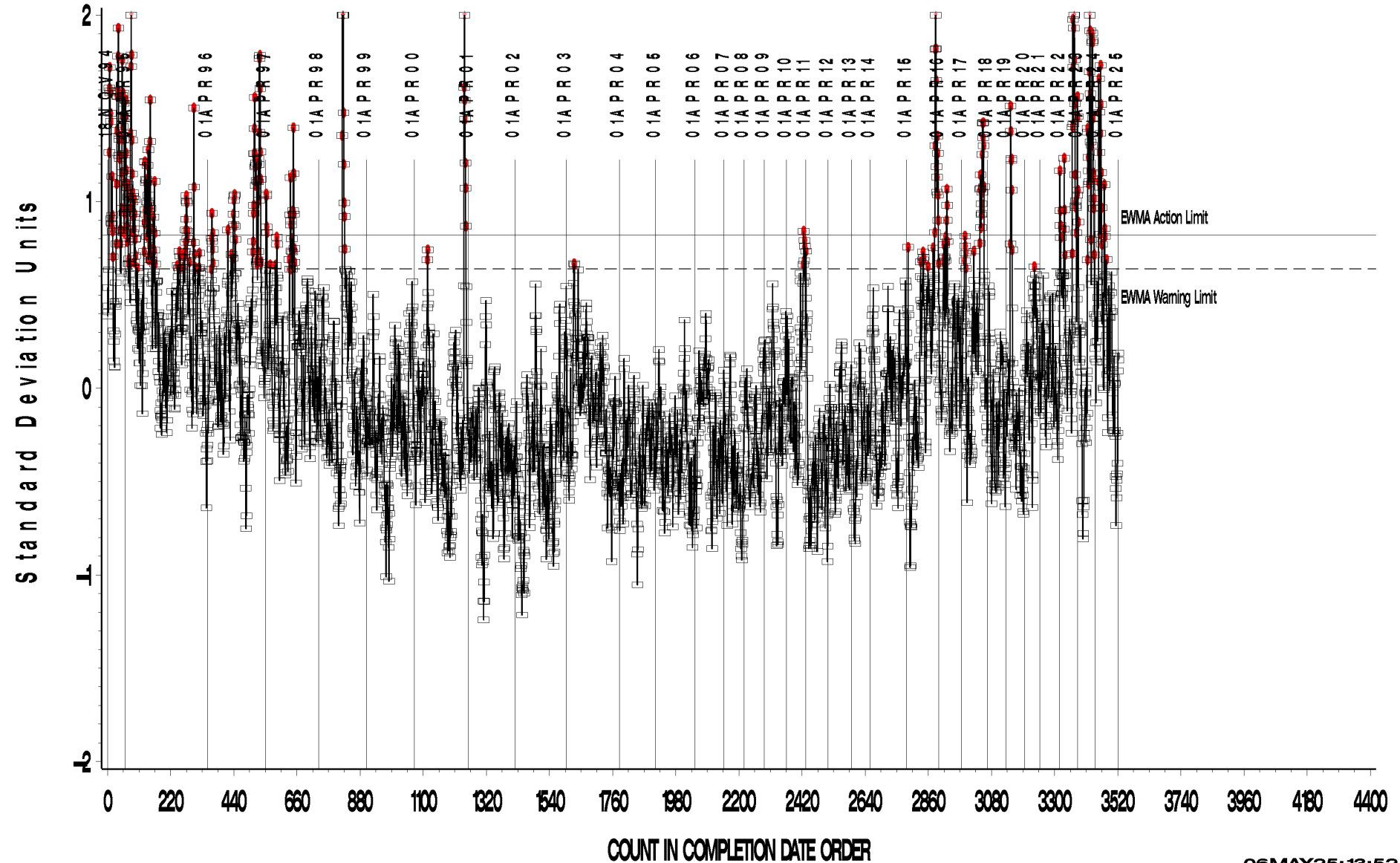


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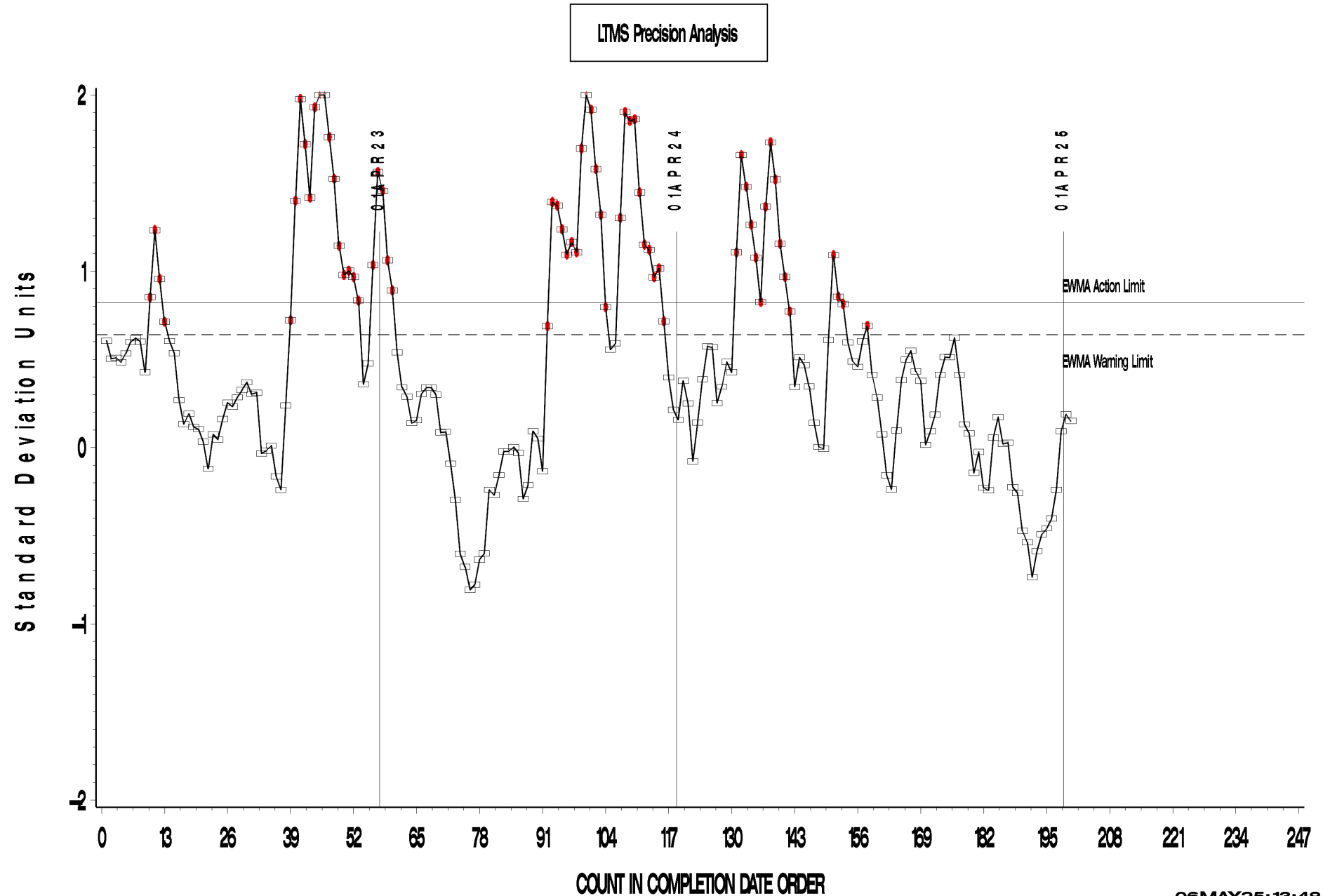


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LTMS Precision Analysis

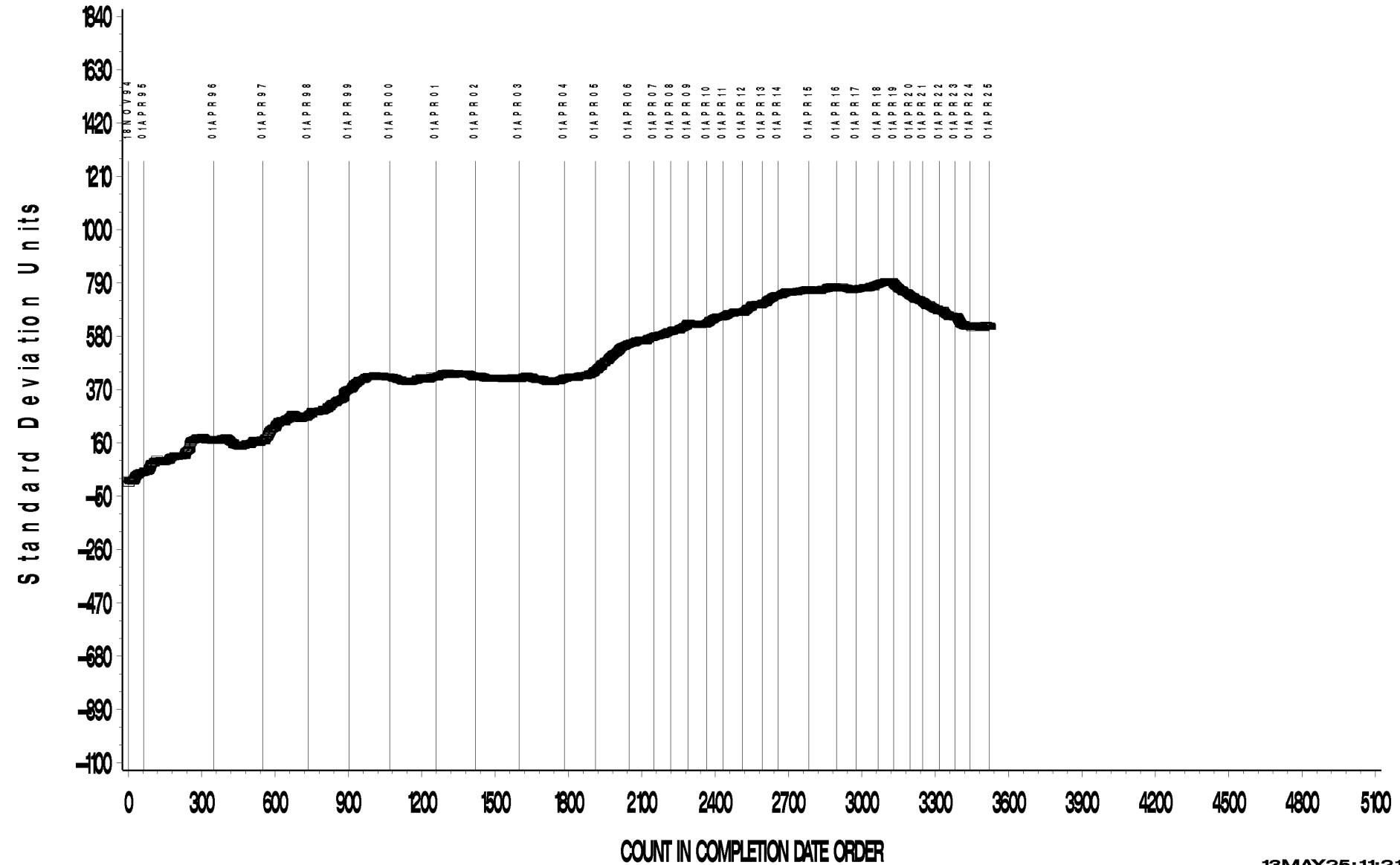


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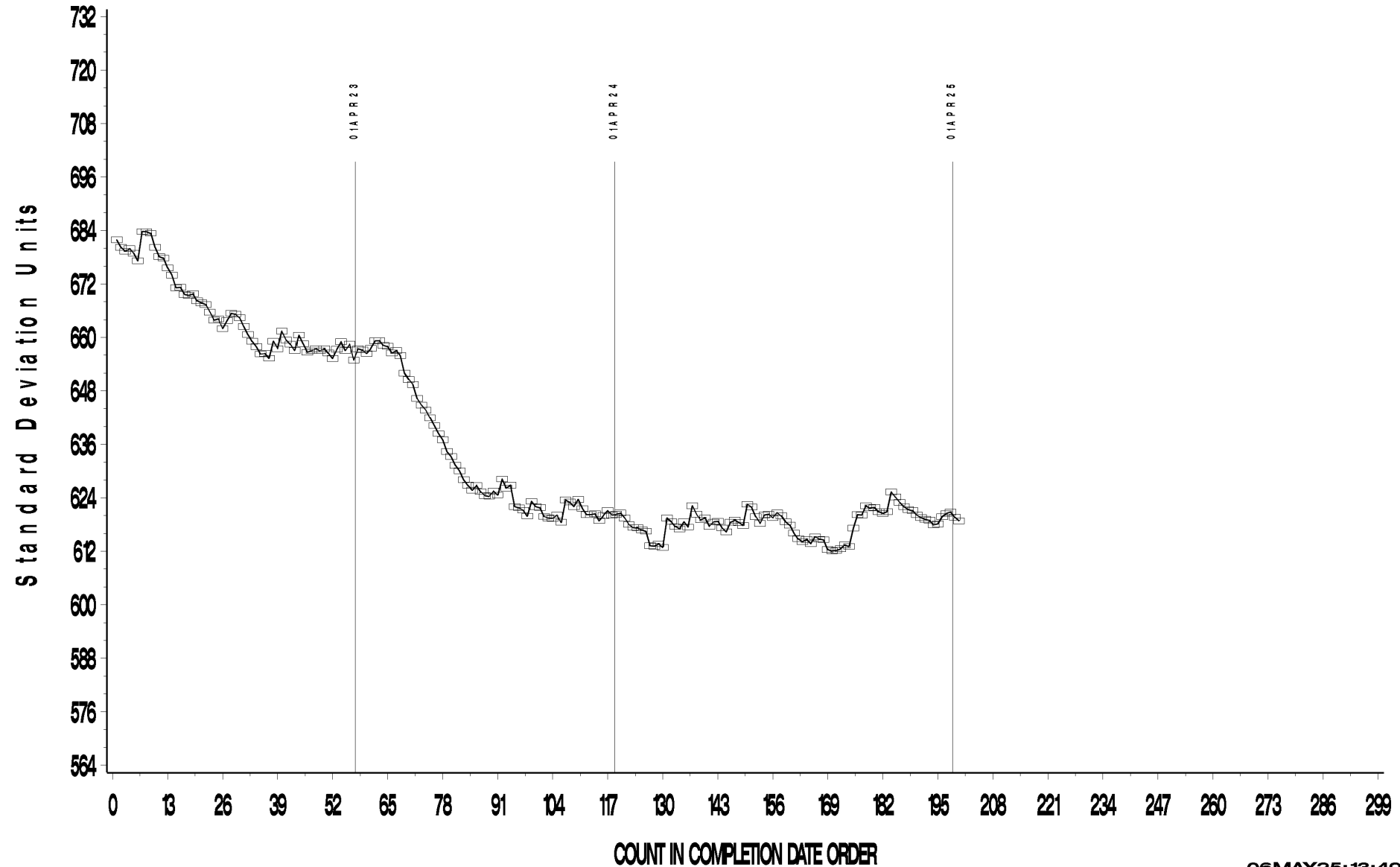
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CUSUM Severity Analysis



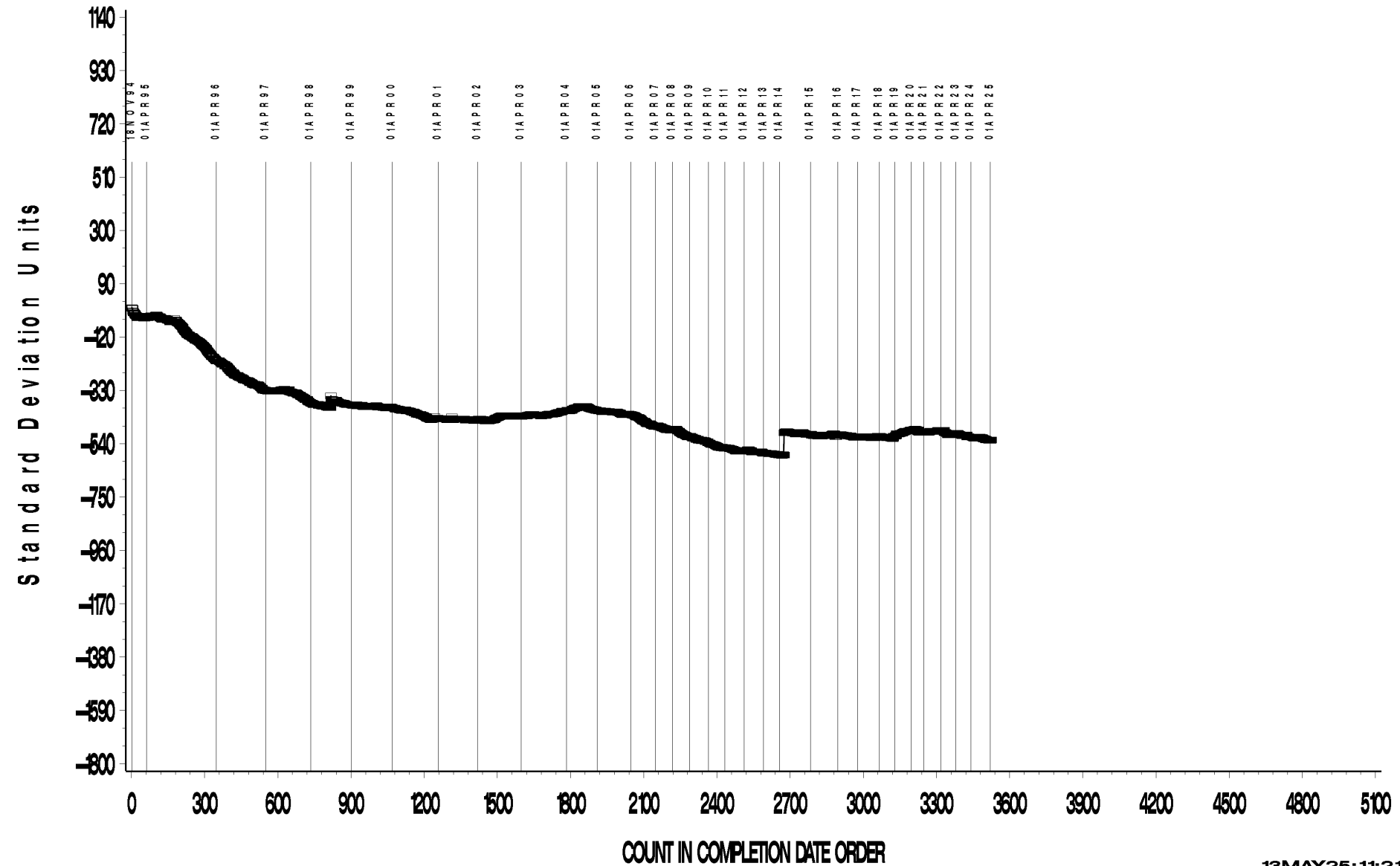
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REF. ELONGATION CHANGE AVG.

CUSUM Severity Analysis



REF. PERCENT VOLUME CHANGE AVG.

CUSUM Severity Analysis



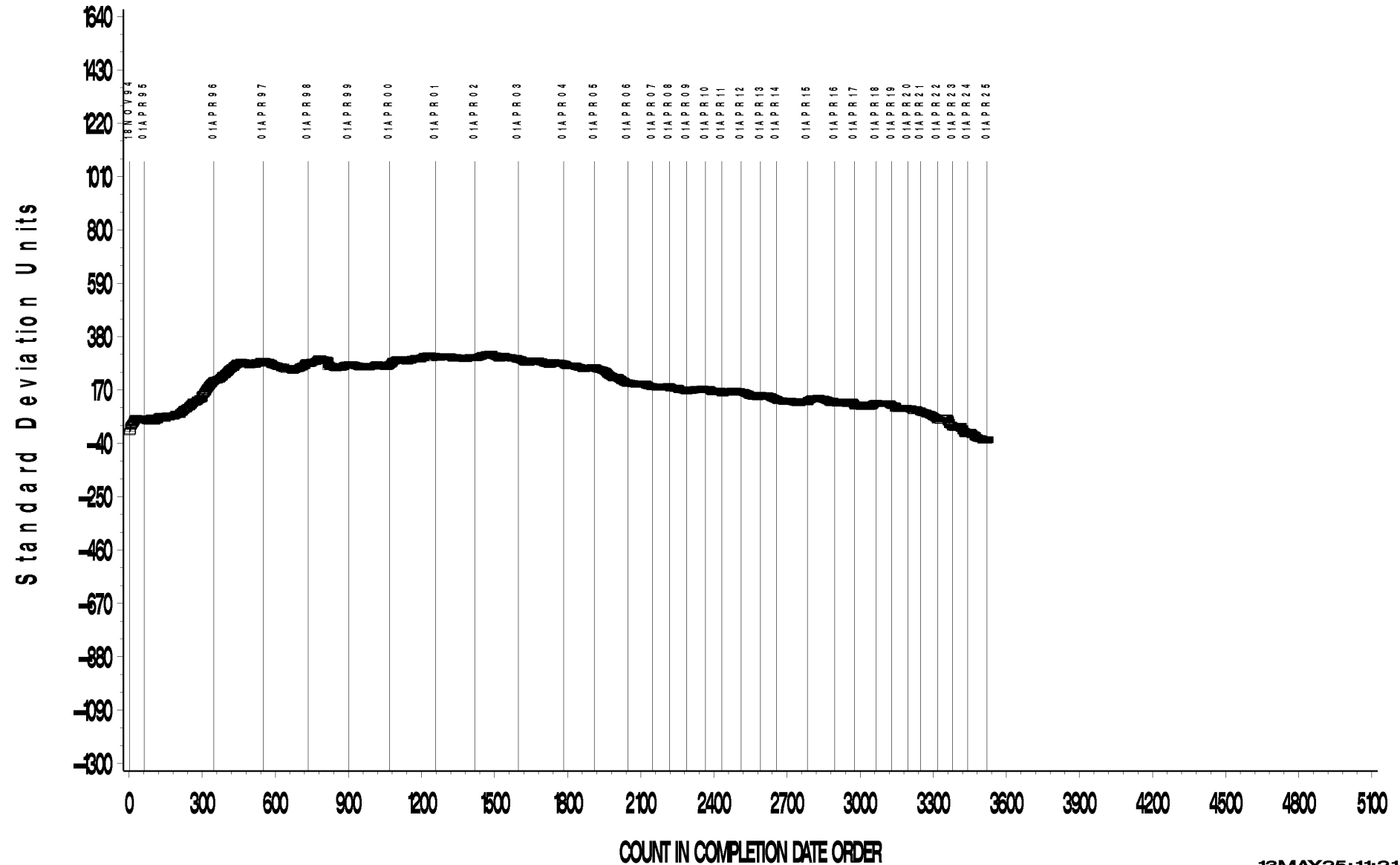
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REF. PERCENT VOLUME CHANGE AVG.

CUSUM Severity Analysis



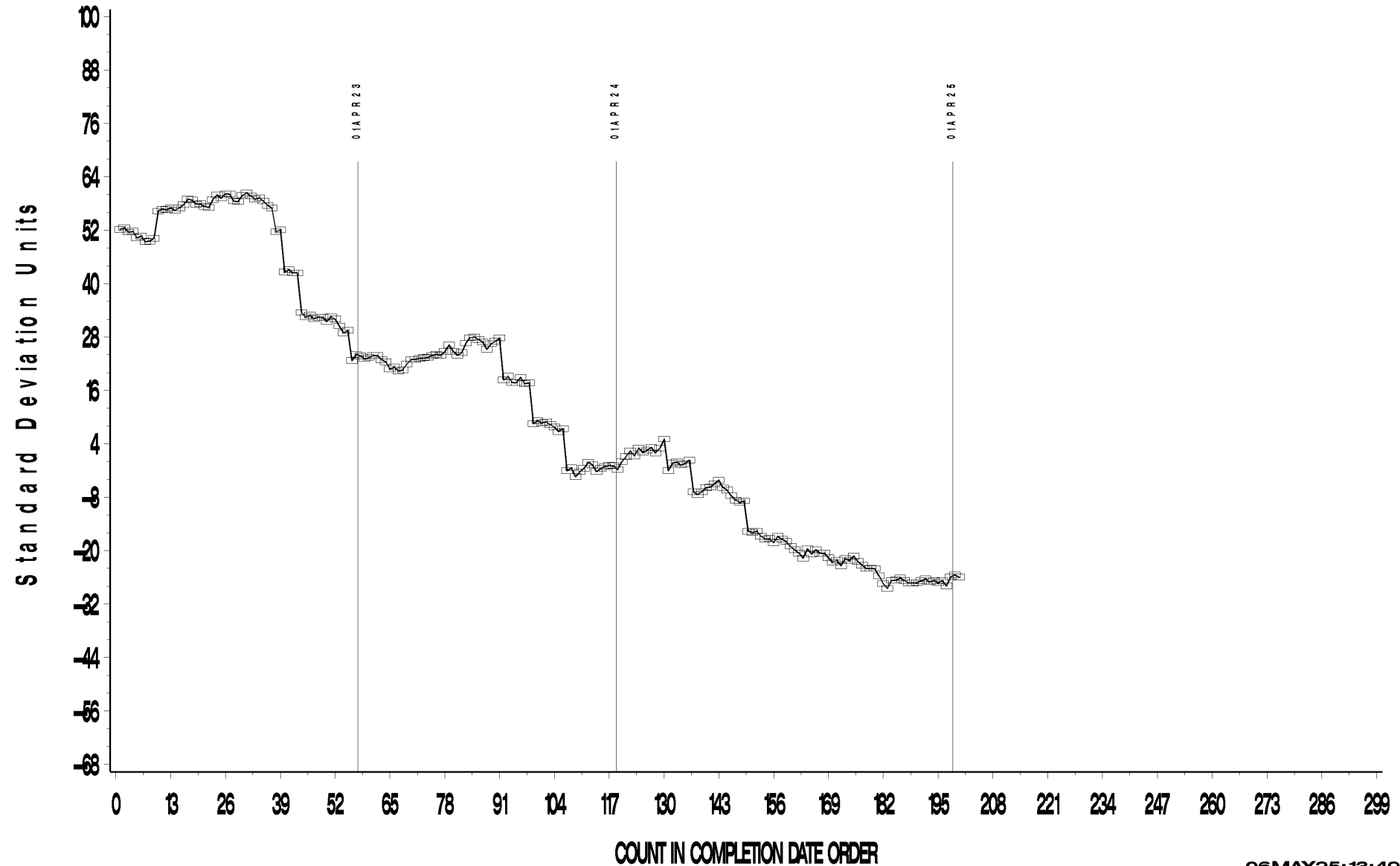
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CUSUM Severity Analysis

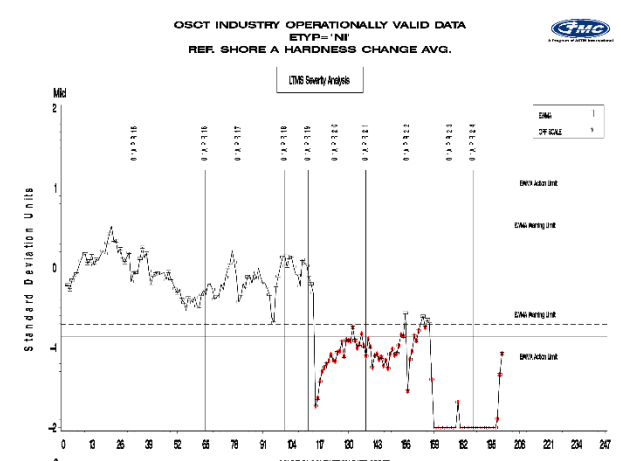
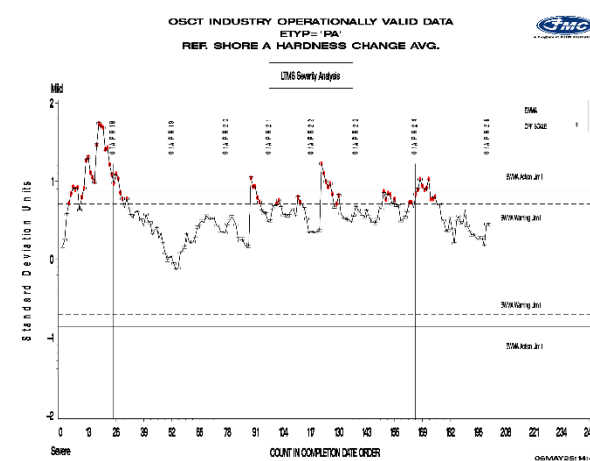
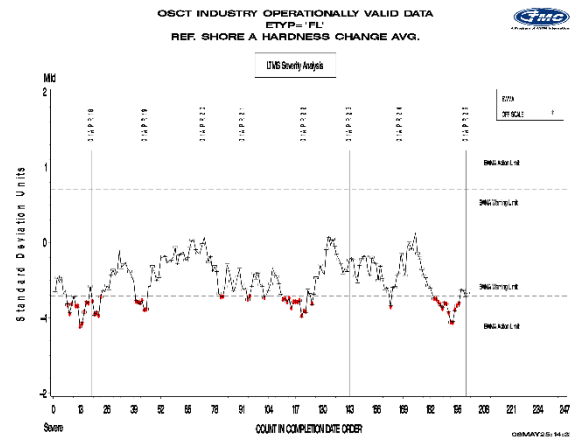
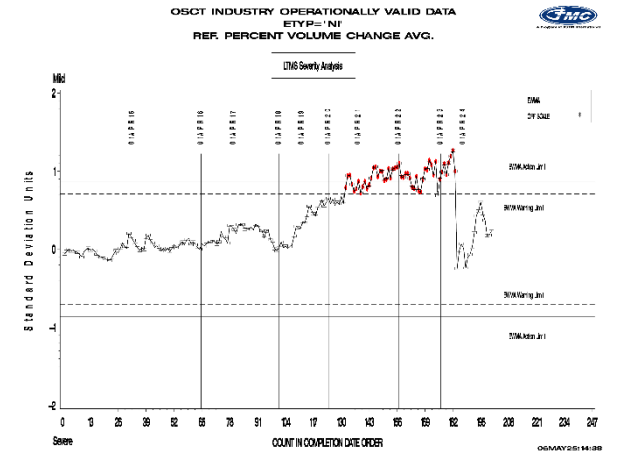
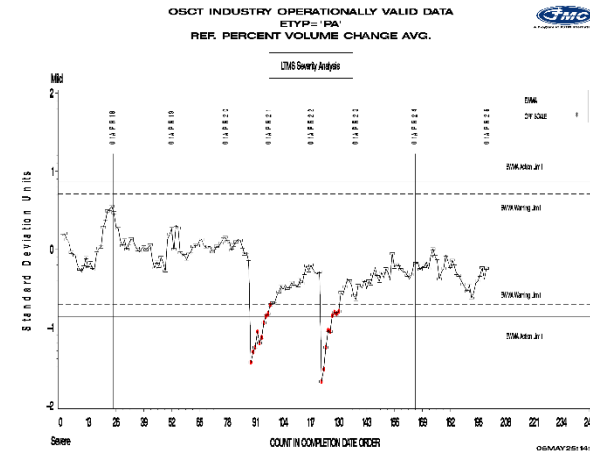
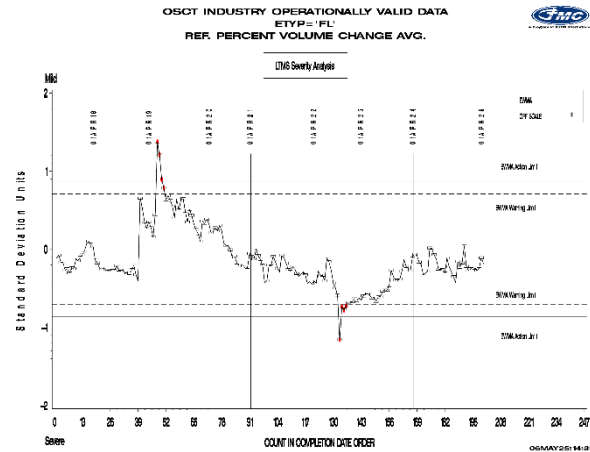
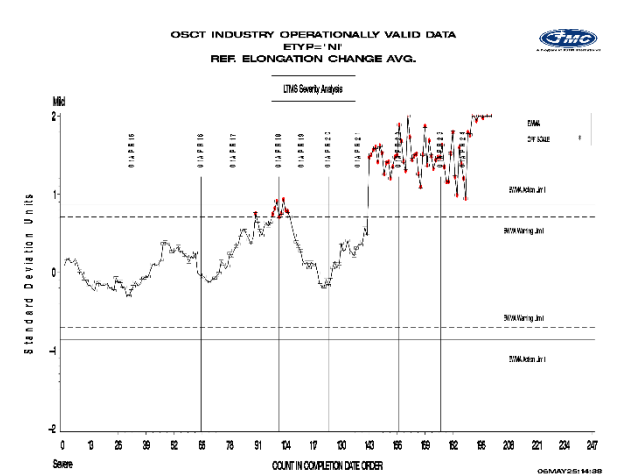
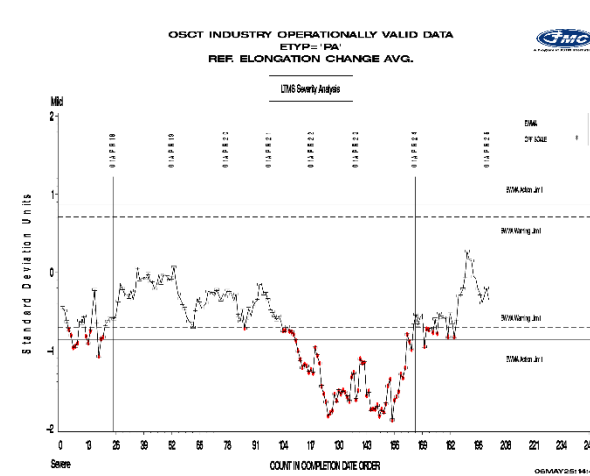
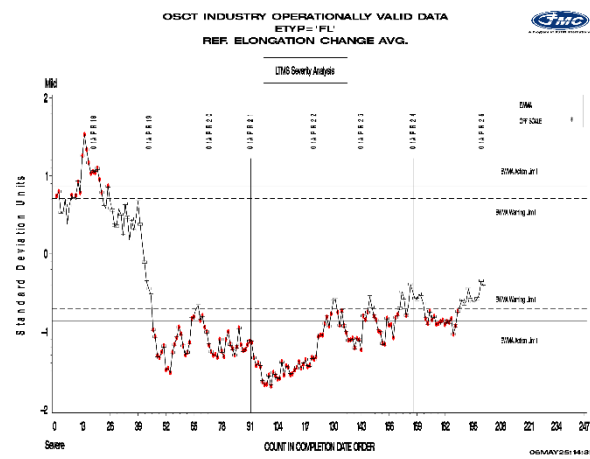


OSCT INDUSTRY OPERATIONALLY VALID DATA
Zoomed to show 200 most recent data points
REF. SHORE A HARDNESS CHANGE AVG.

CUSUM Severity Analysis

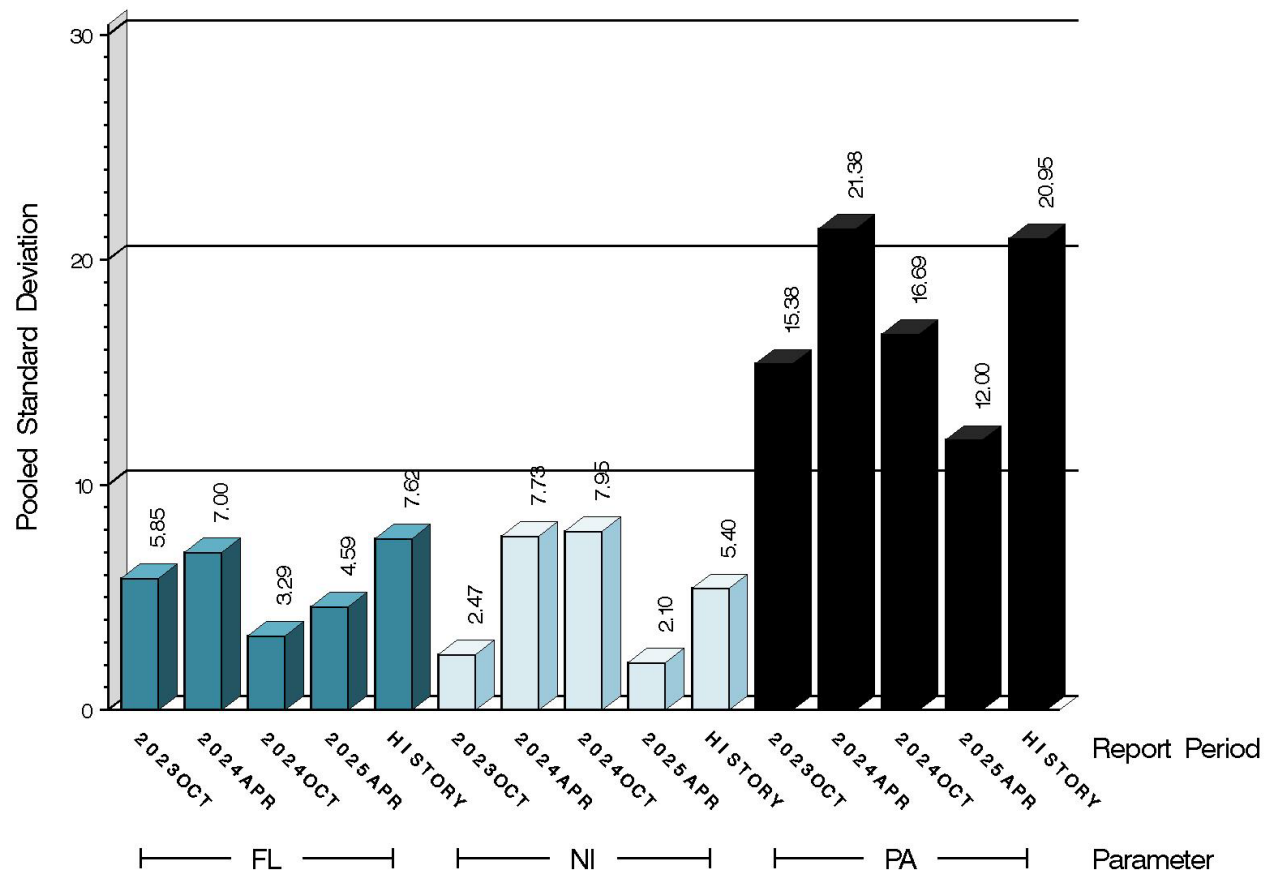


By-Elastomer Plots



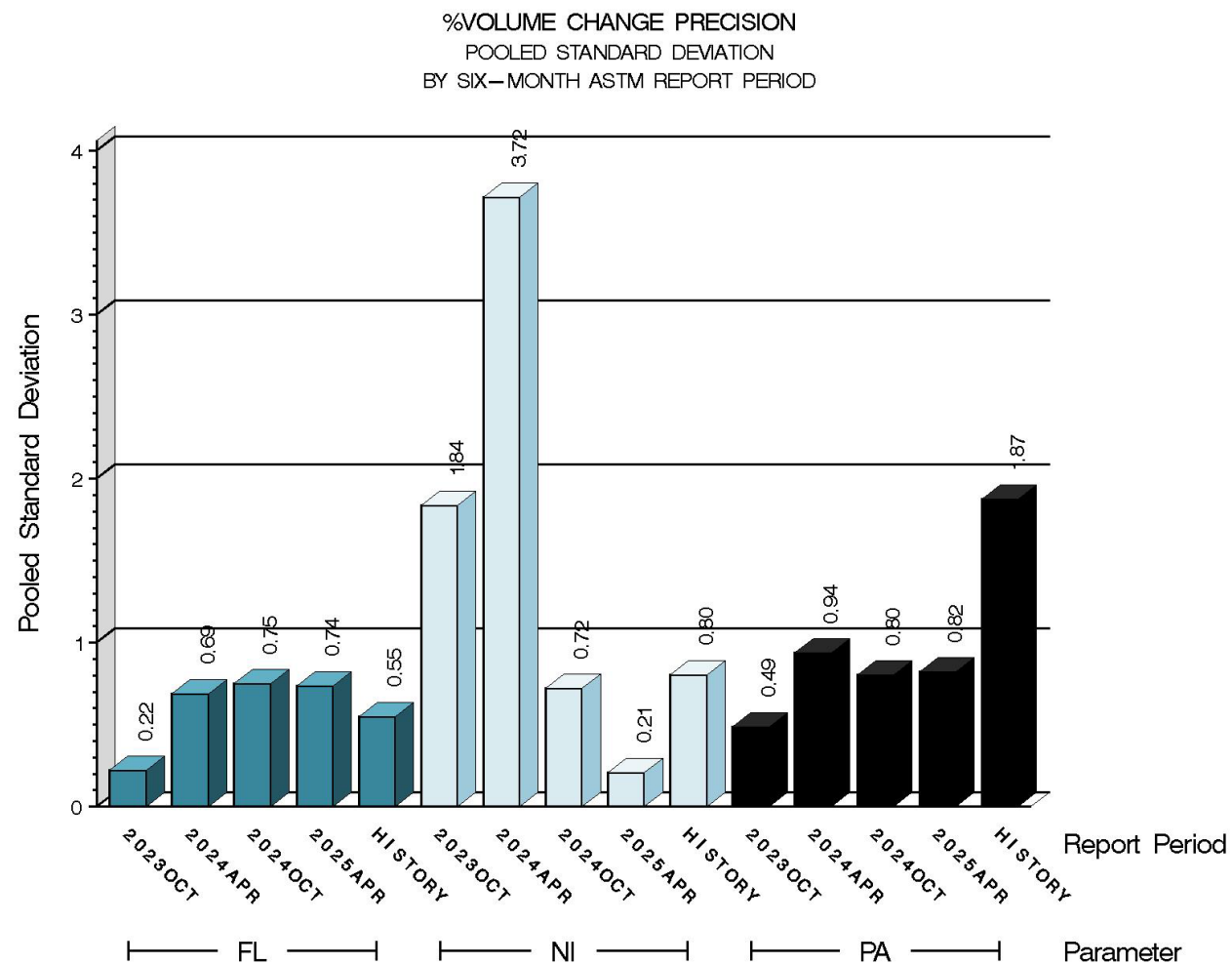
OSCT Precision Estimates

%ELONGATION PRECISION
POOLED STANDARD DEVIATION
BY SIX-MONTH ASTM REPORT PERIOD



9:34:03 05MAY2025

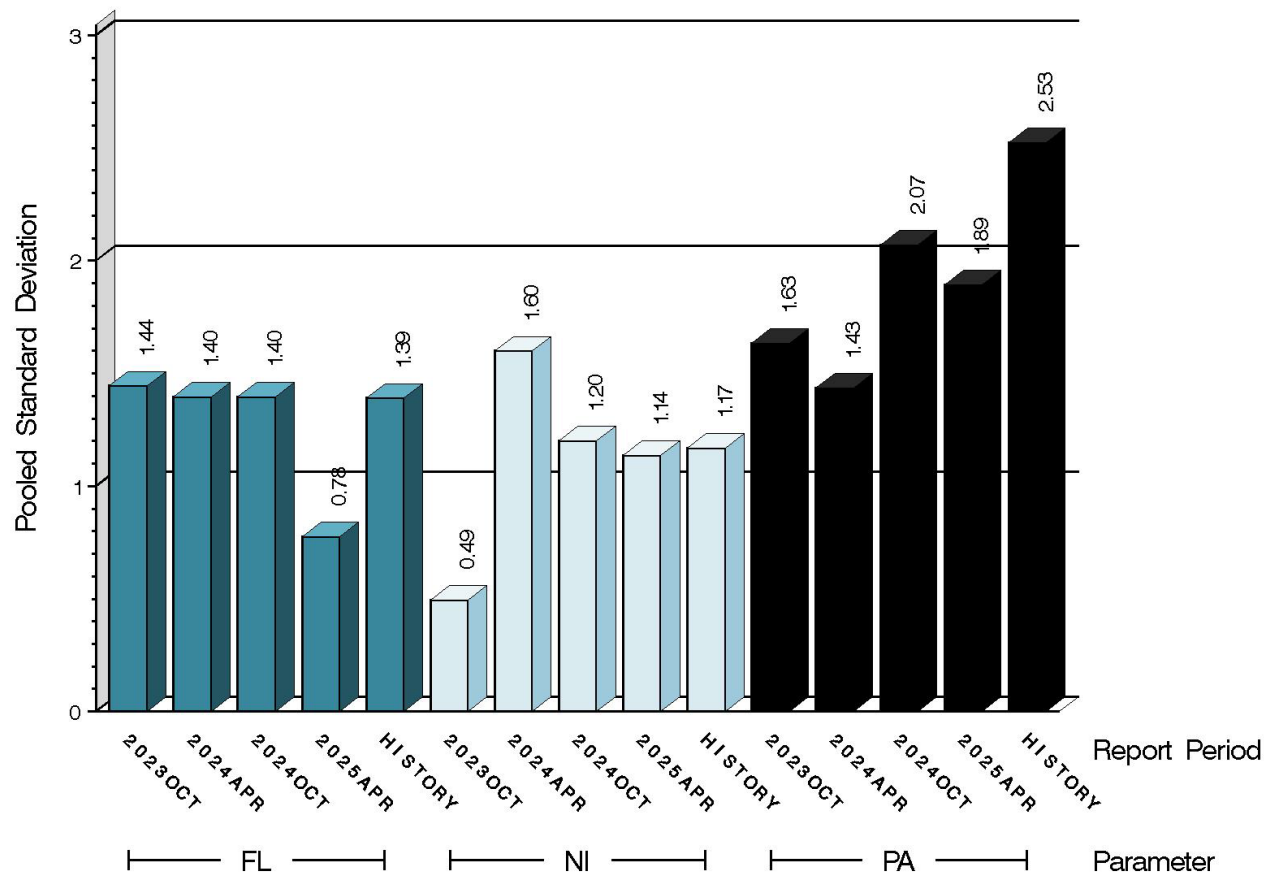
OSCT Precision Estimates



9/34/03 05MAY2025

OSCT Precision Estimates

S.A. HARDNESS PRECISION
POOLED STANDARD DEVIATION
BY SIX-MONTH ASTM REPORT PERIOD



9/34/03 09MAY2025

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Test Monitoring Center
<https://www.astmtmc.org>



L37 RC

➤➤ April 2025

L37RC Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	11
Unacceptable Calibration Test	OC	7
Total		18

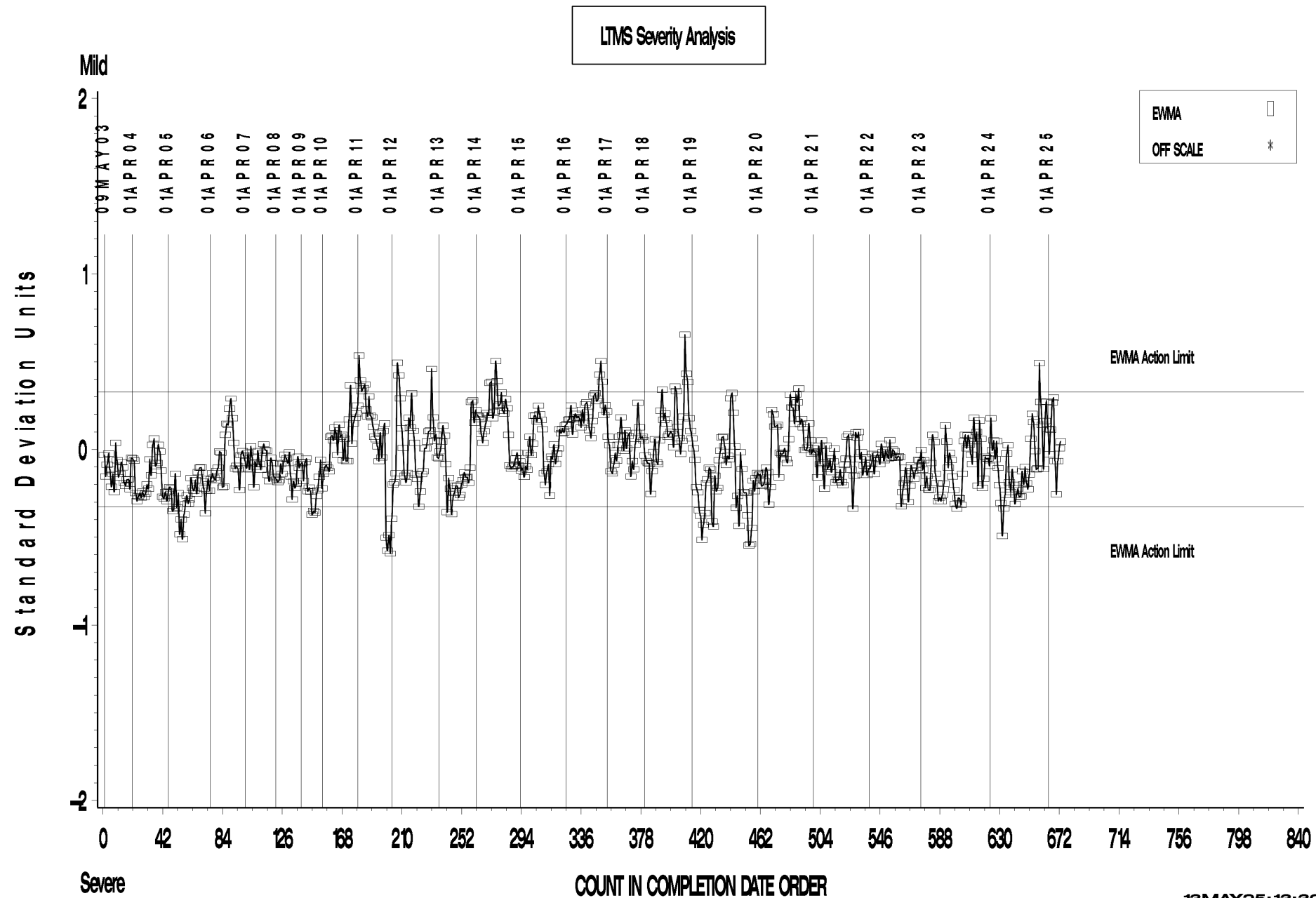
L37RC Activity

Test Status	Validity Code	#
Unacceptable Calibration Test (Mild)	OC	2
Unacceptable Calibration Test (Severe)	OC	3
Unacceptable Calibration Test (Multiple)	OC	2
Unacceptable Calibration Test (Precision)	OC	0
Total		7

L37RC Test Severity

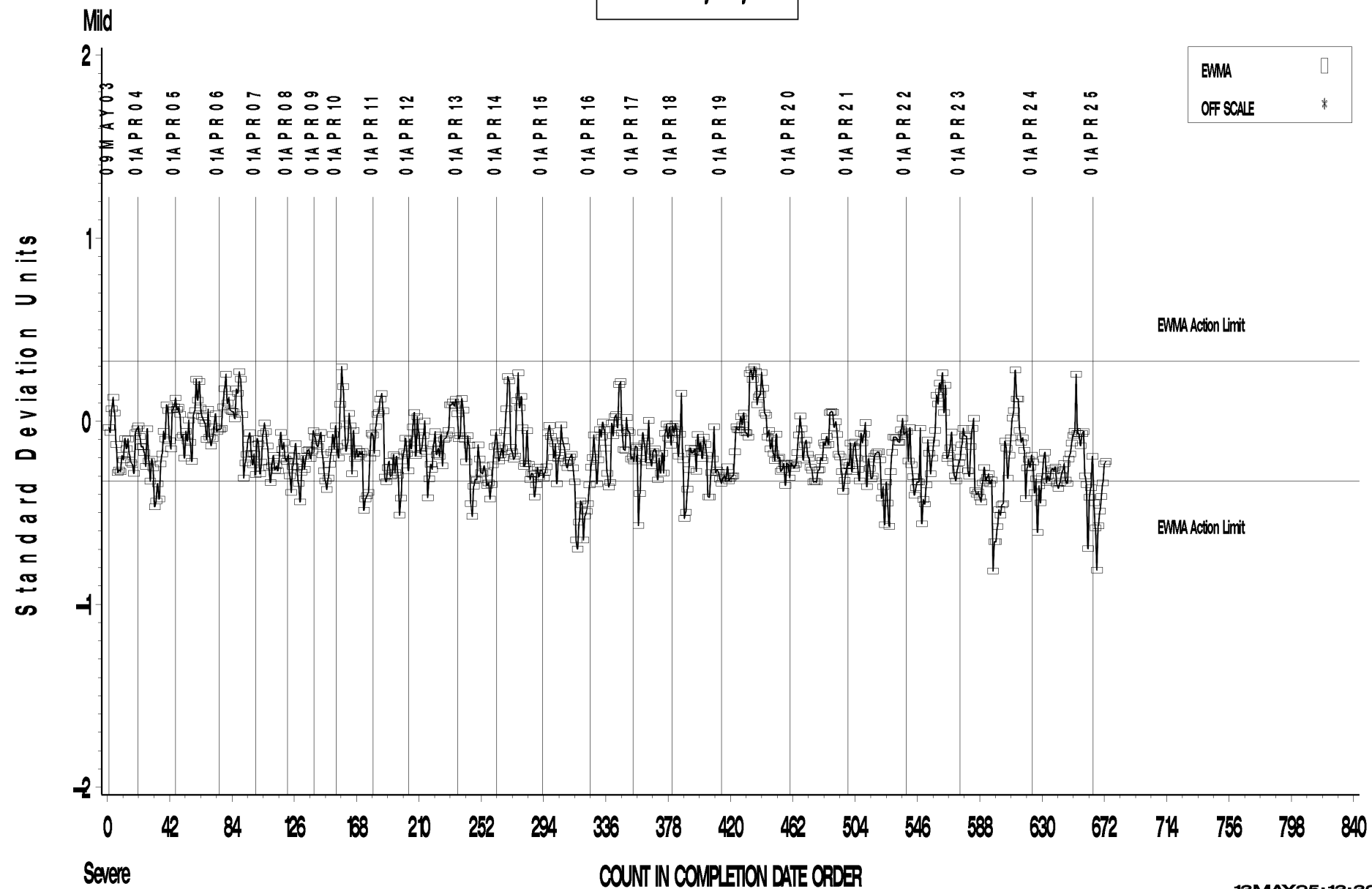
- Severity:
 - RIPP, RIDG, and SPIT all exceeded the action limit in the severe direction during this reporting period and have since returned within limits.
 - WEAR exceeded the action limit in the mild direction during this reporting period and has since returned within limits.
- Precision:
 - All parameters remained within the action limit this period.

WEAR



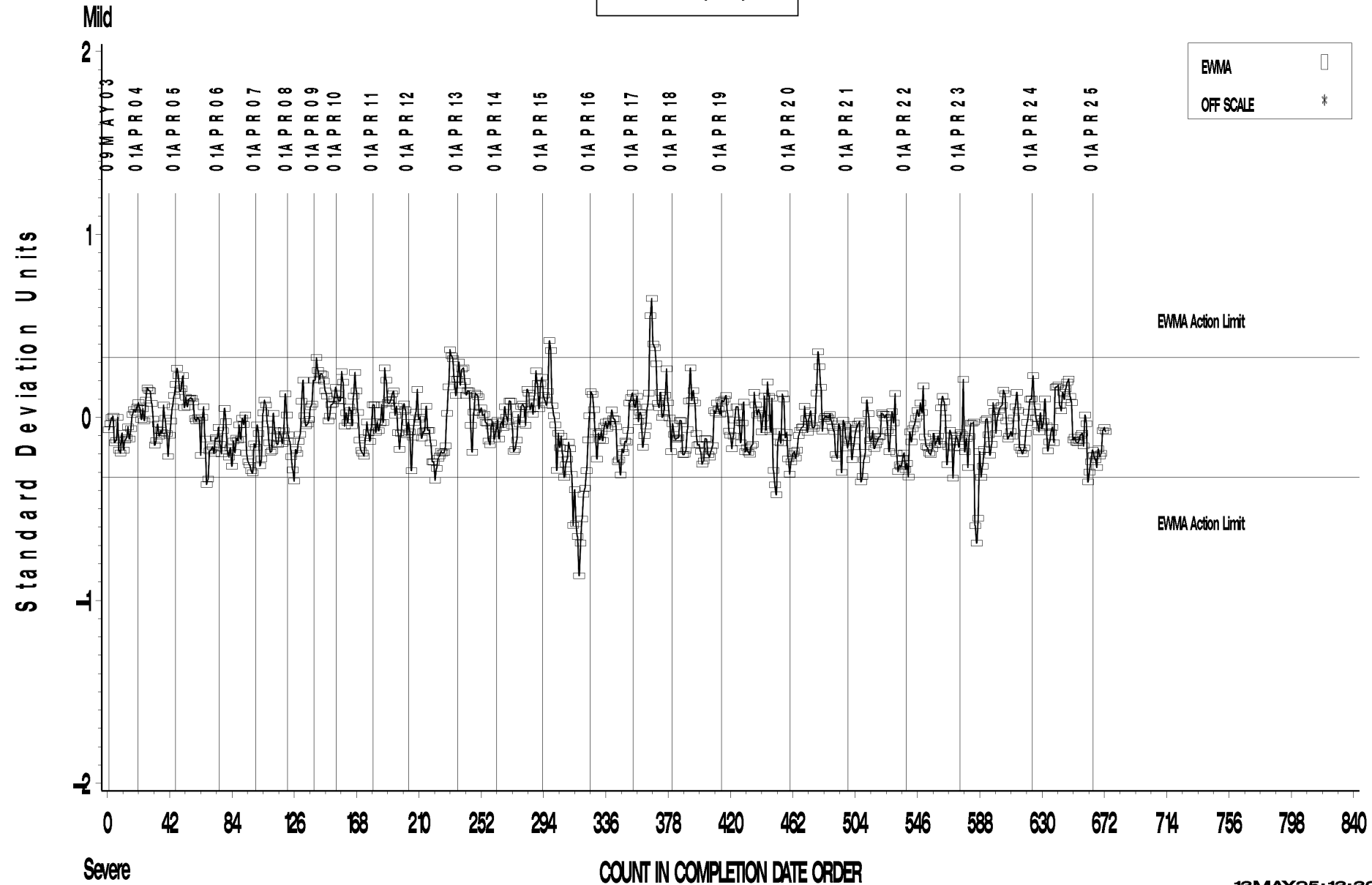
RIDGING

LTMS Severity Analysis



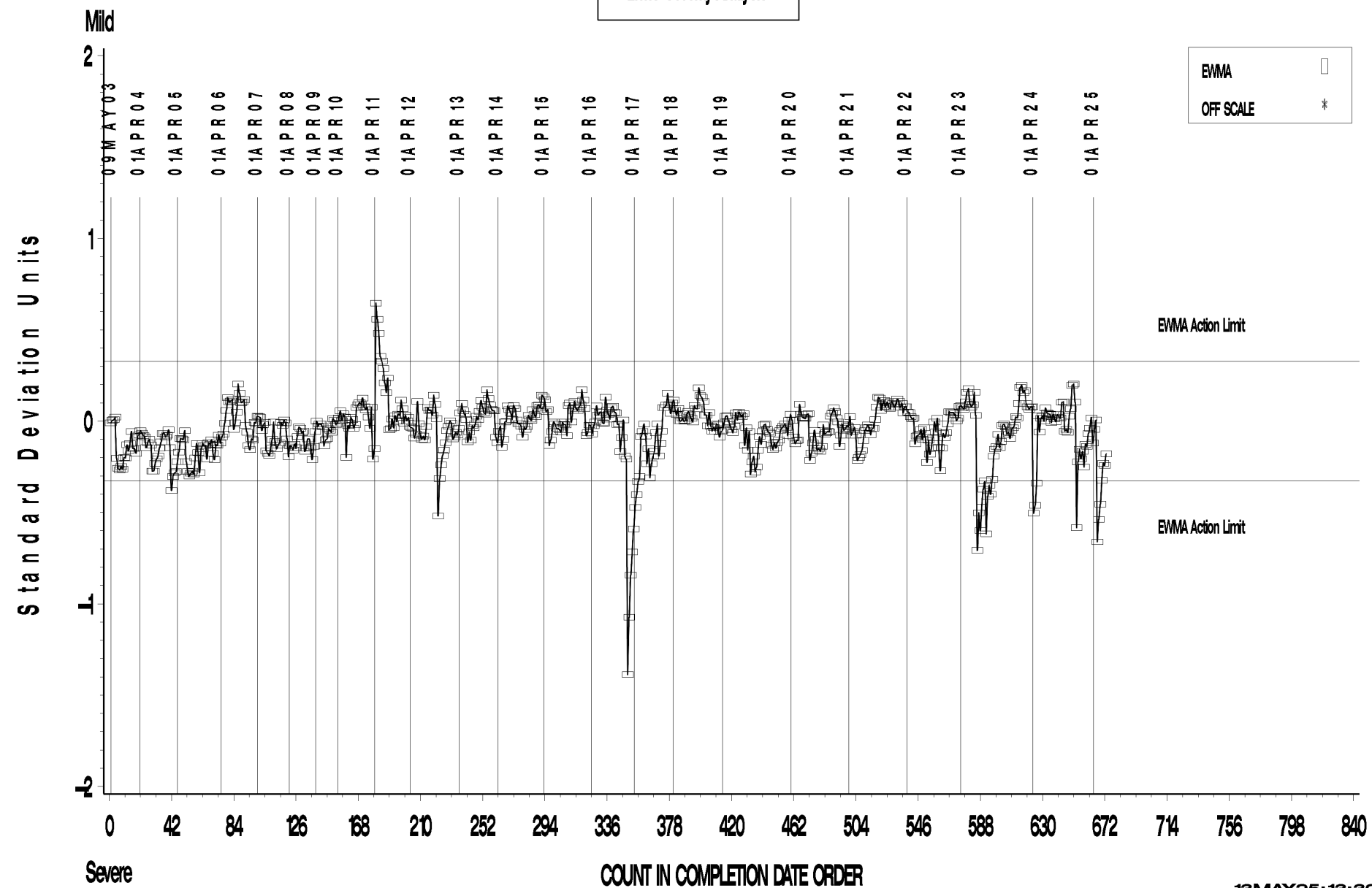
RIPPLING

LTMS Severity Analysis



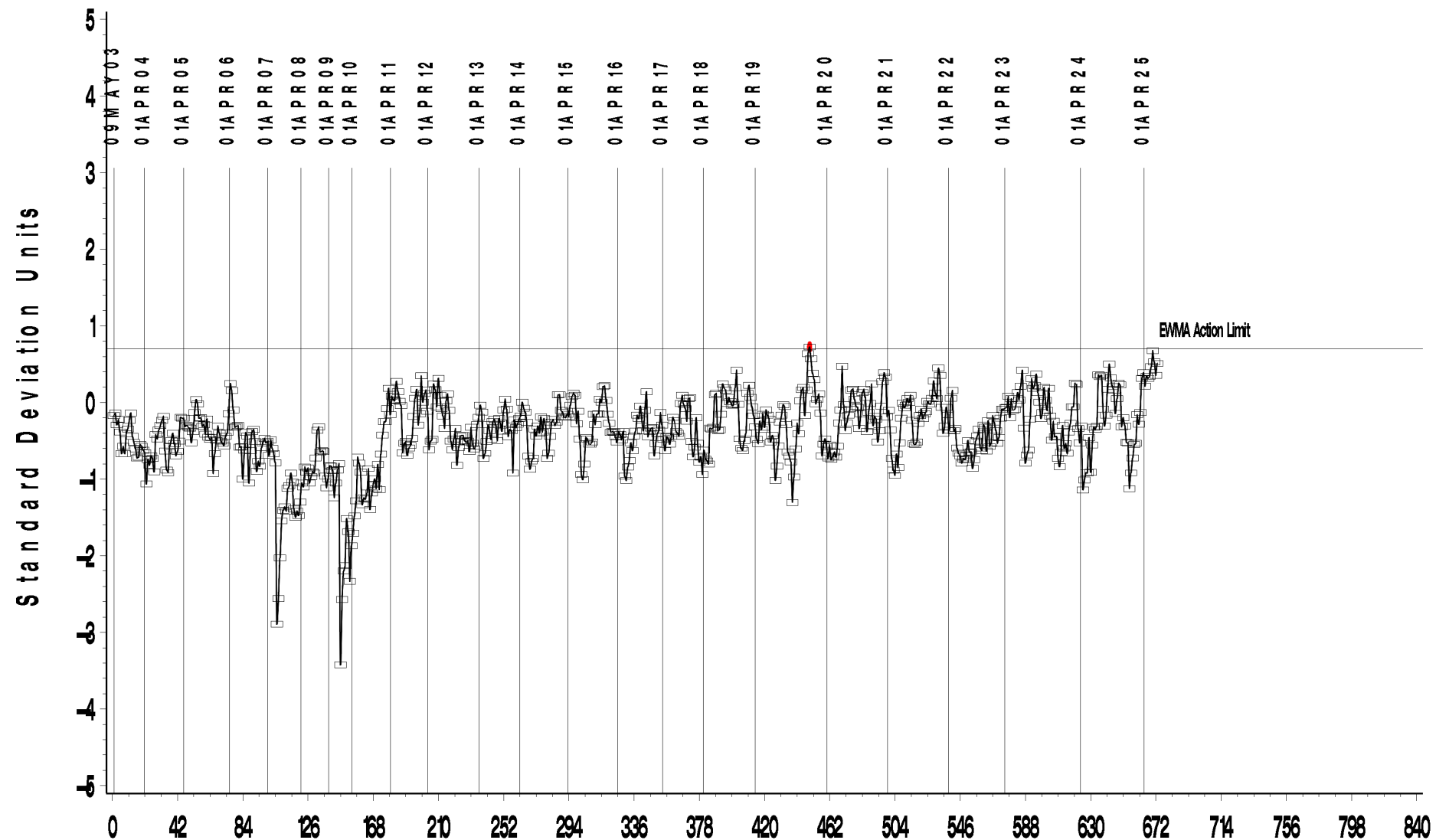
SPITTING

LTMS Severity Analysis



WEAR

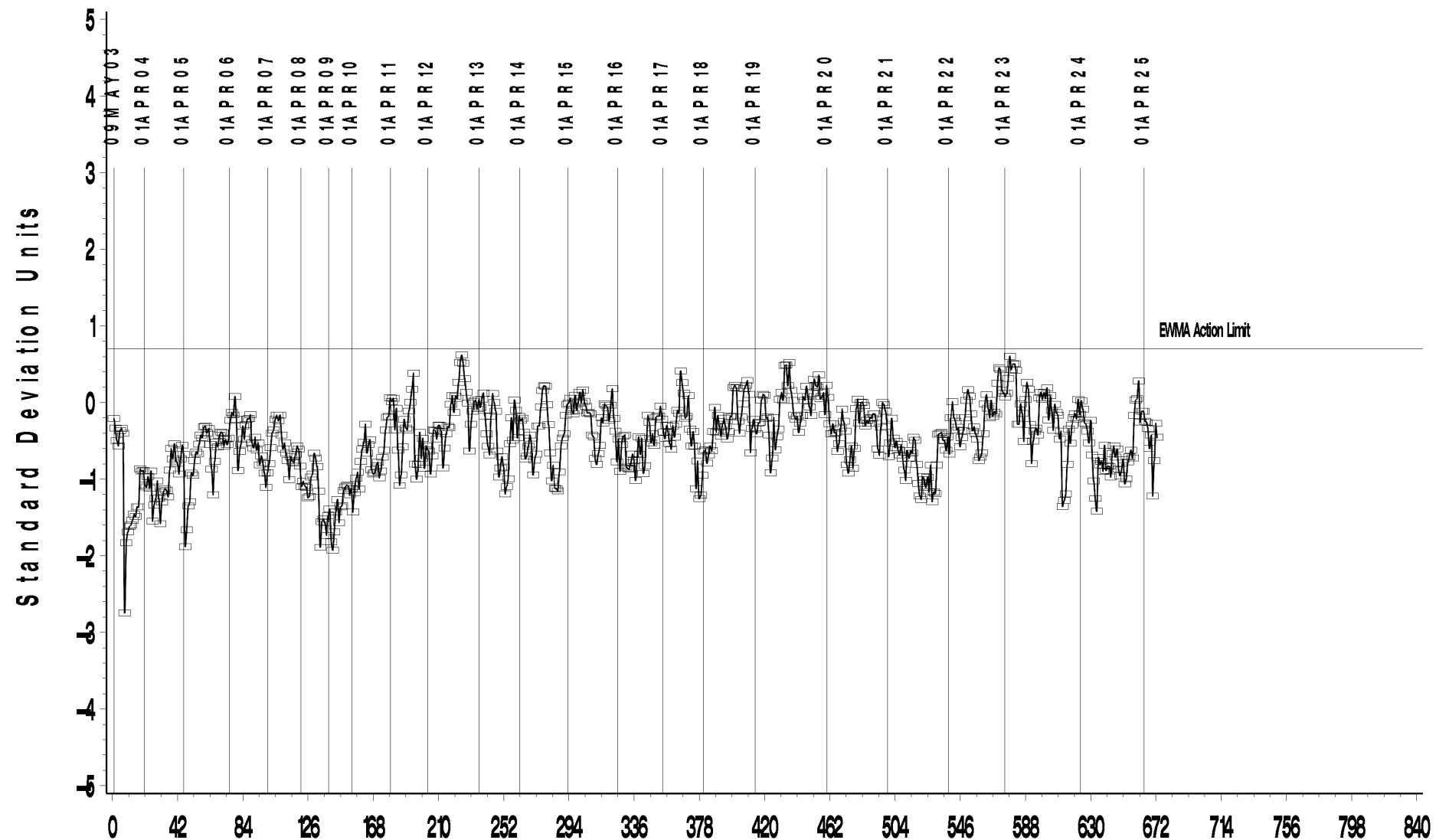
LTMS Precision Analysis



COUNT IN COMPLETION DATE ORDER

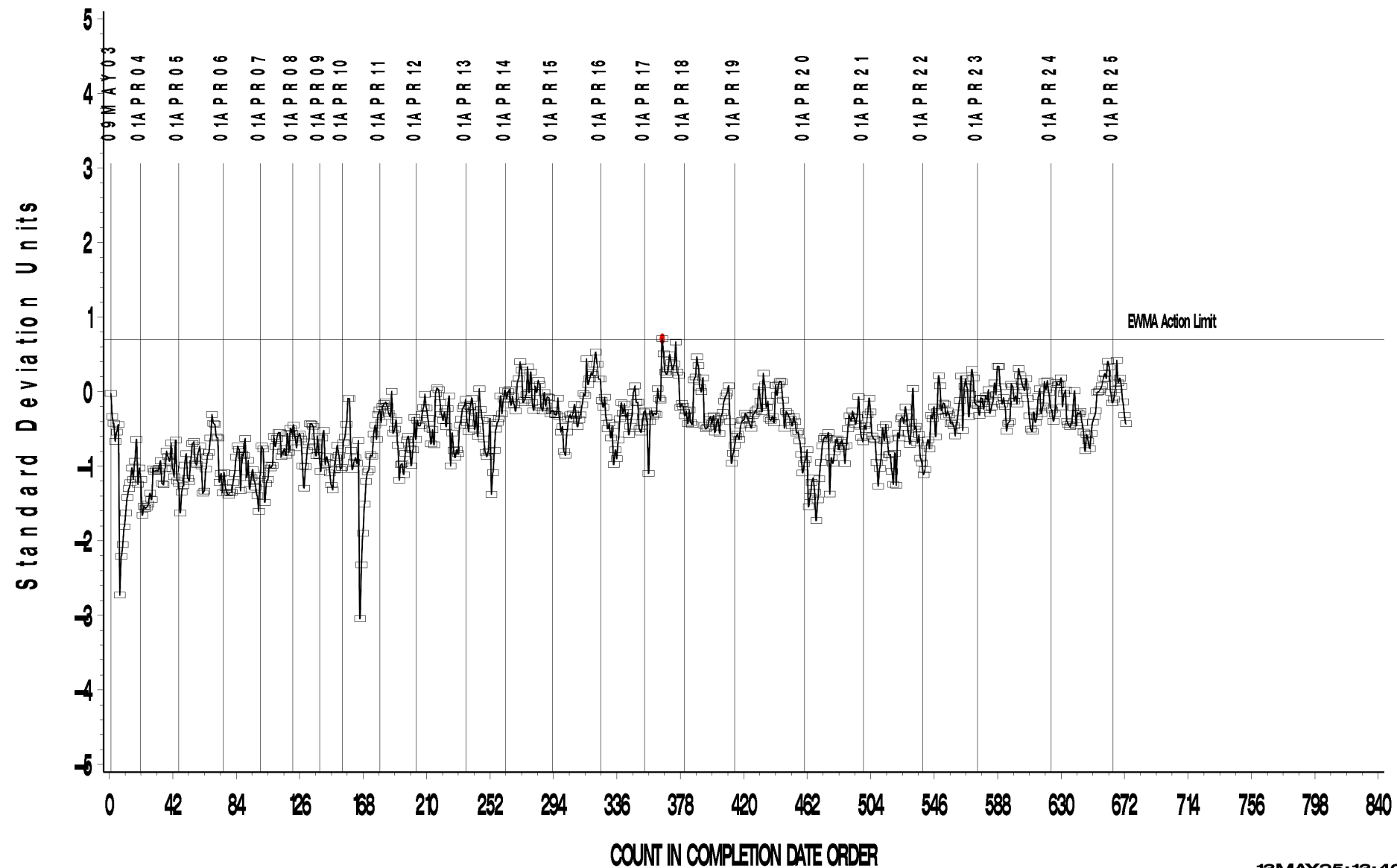
RIPPLING

LTMS Precision Analysis



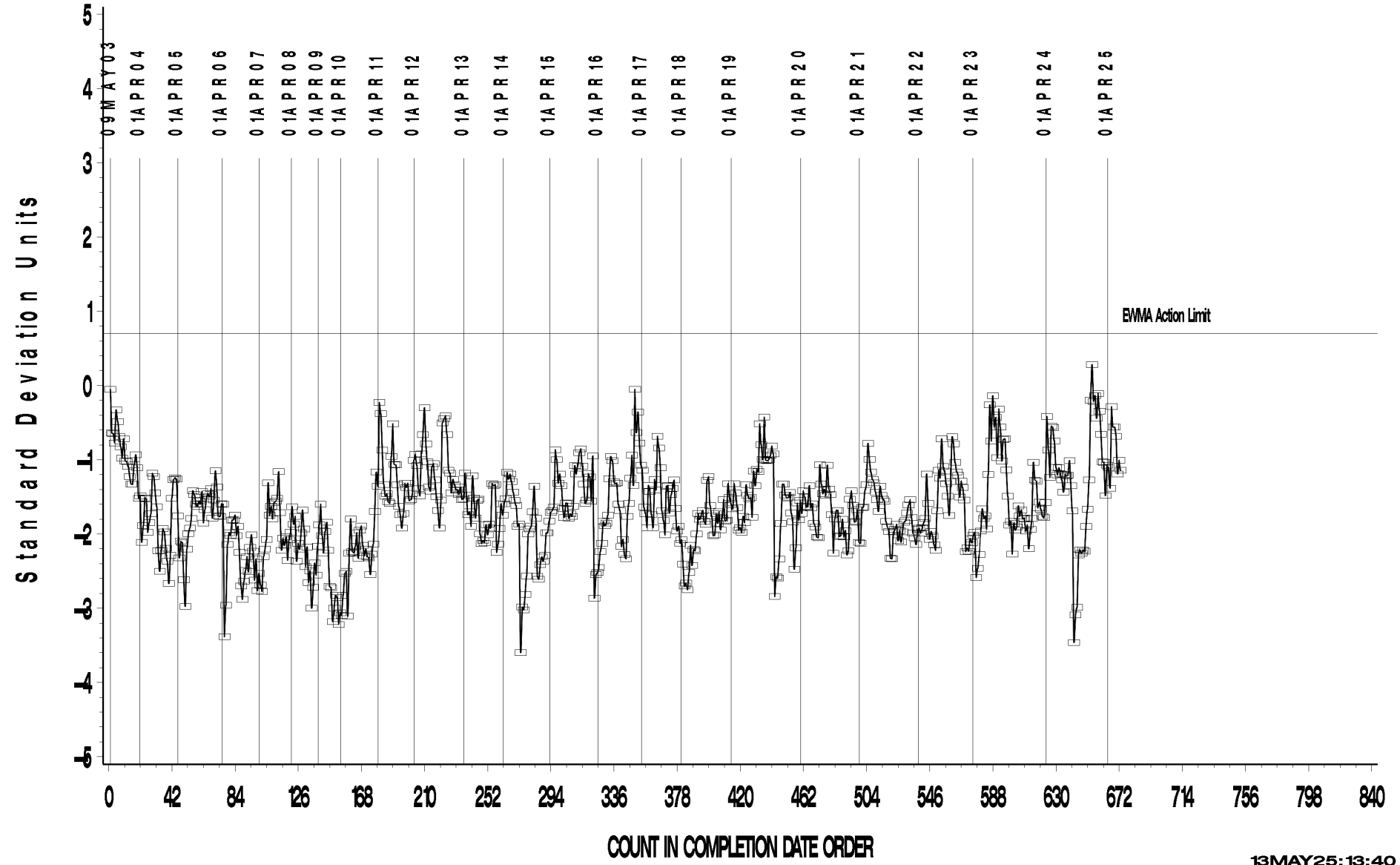
RIDGING

LTMS Precision Analysis



SPITTING

LTMS Precision Analysis



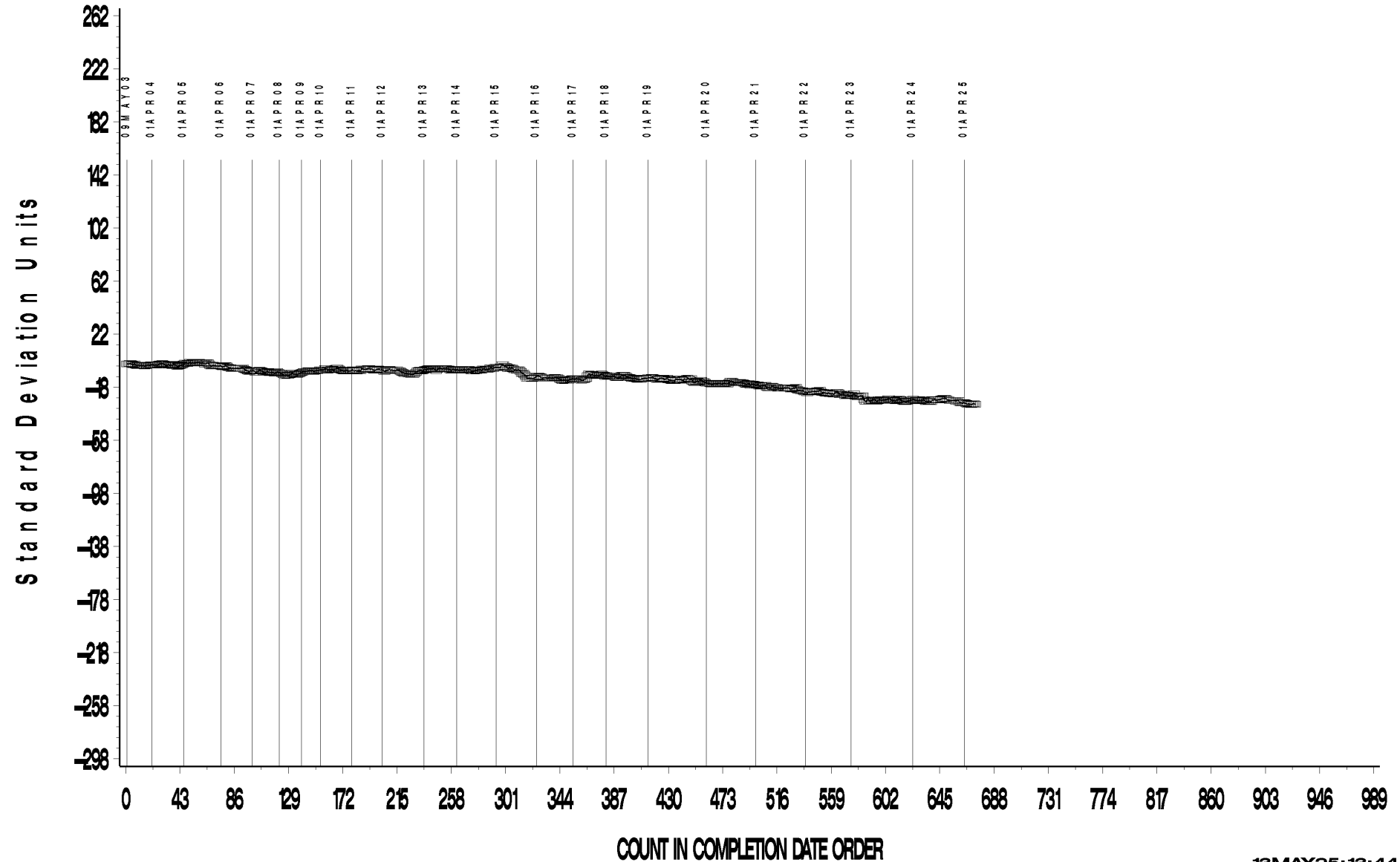
WEAR

CUSUM Severity Analysis



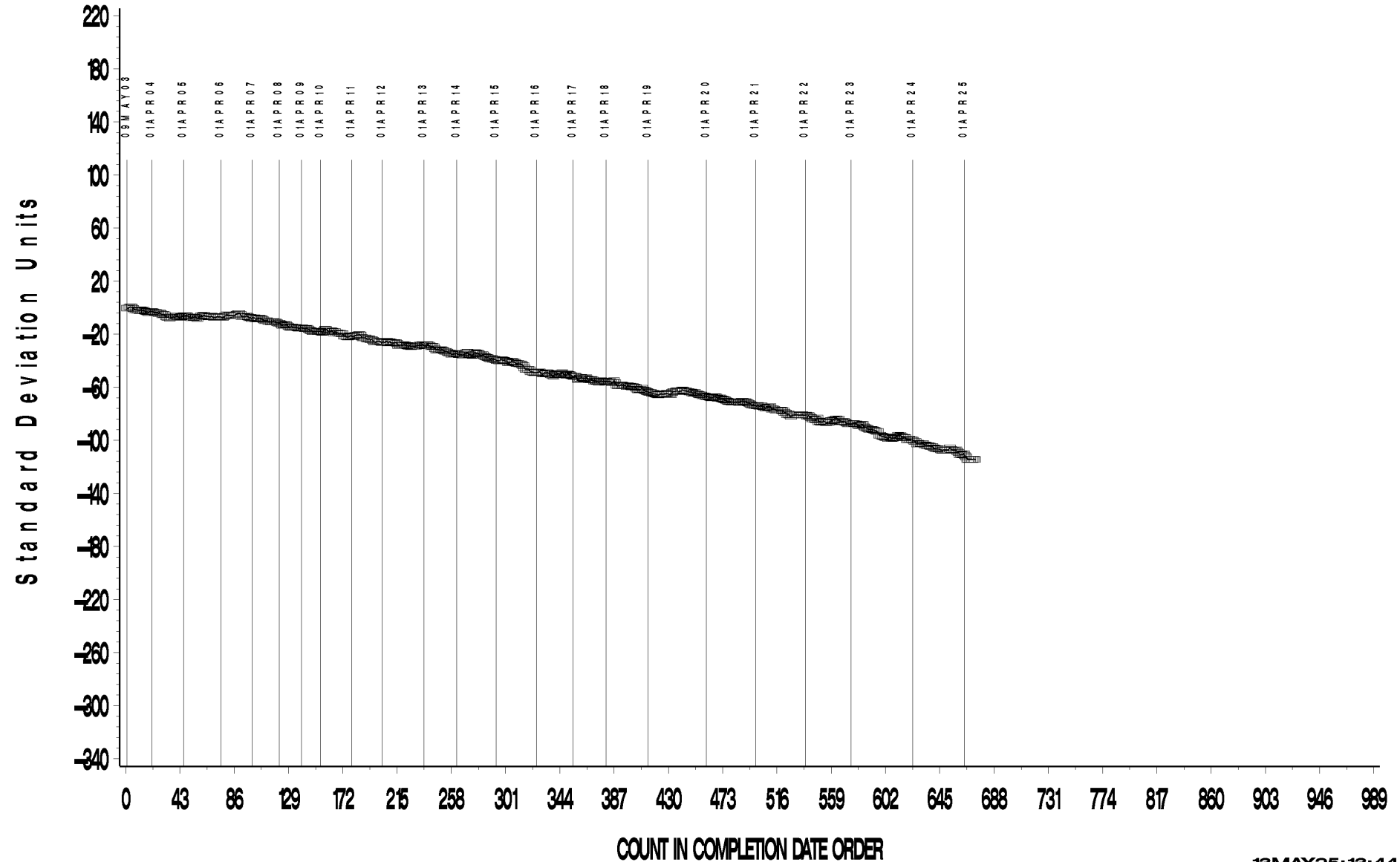
RIPPLING

CUSUM Severity Analysis



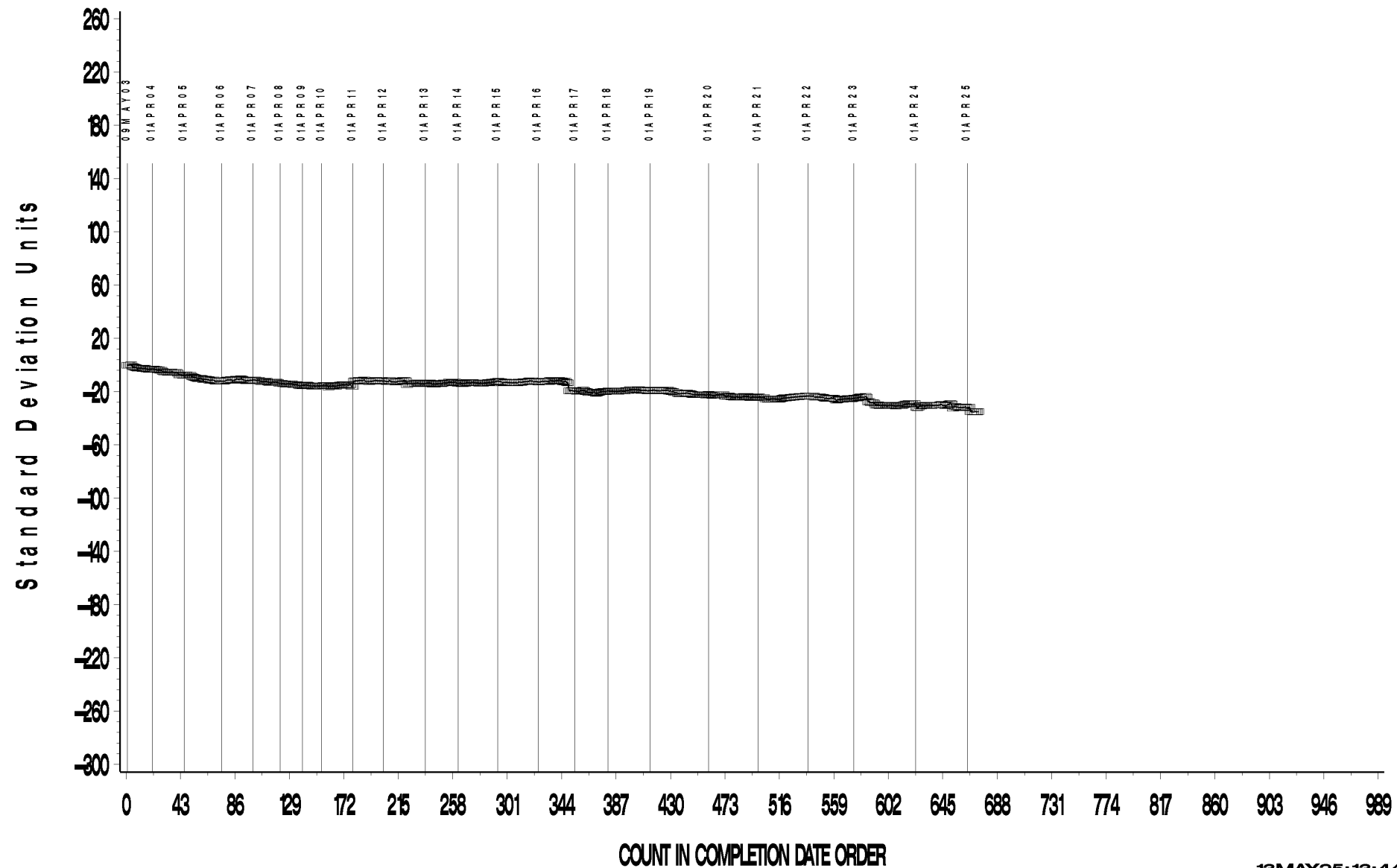
RIDGING

CUSUM Severity Analysis



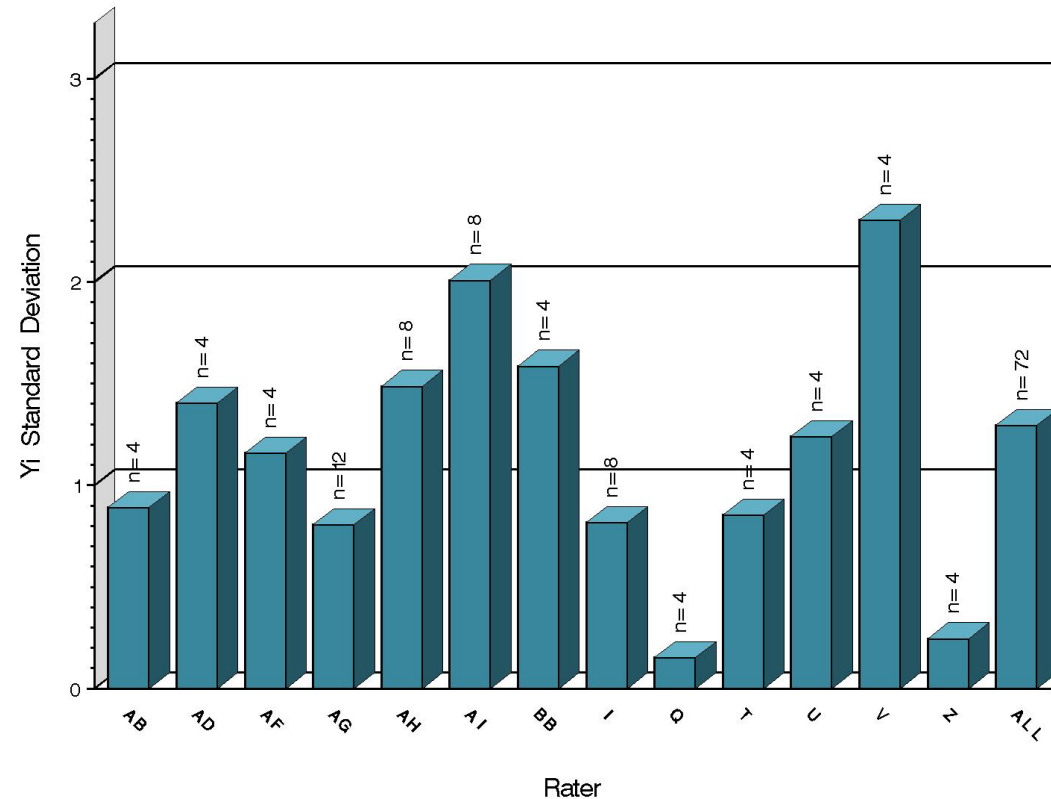
SPITTING

CUSUM Severity Analysis



L37RC Precision Estimates

WEAR
Precision as Measured by Yi STD



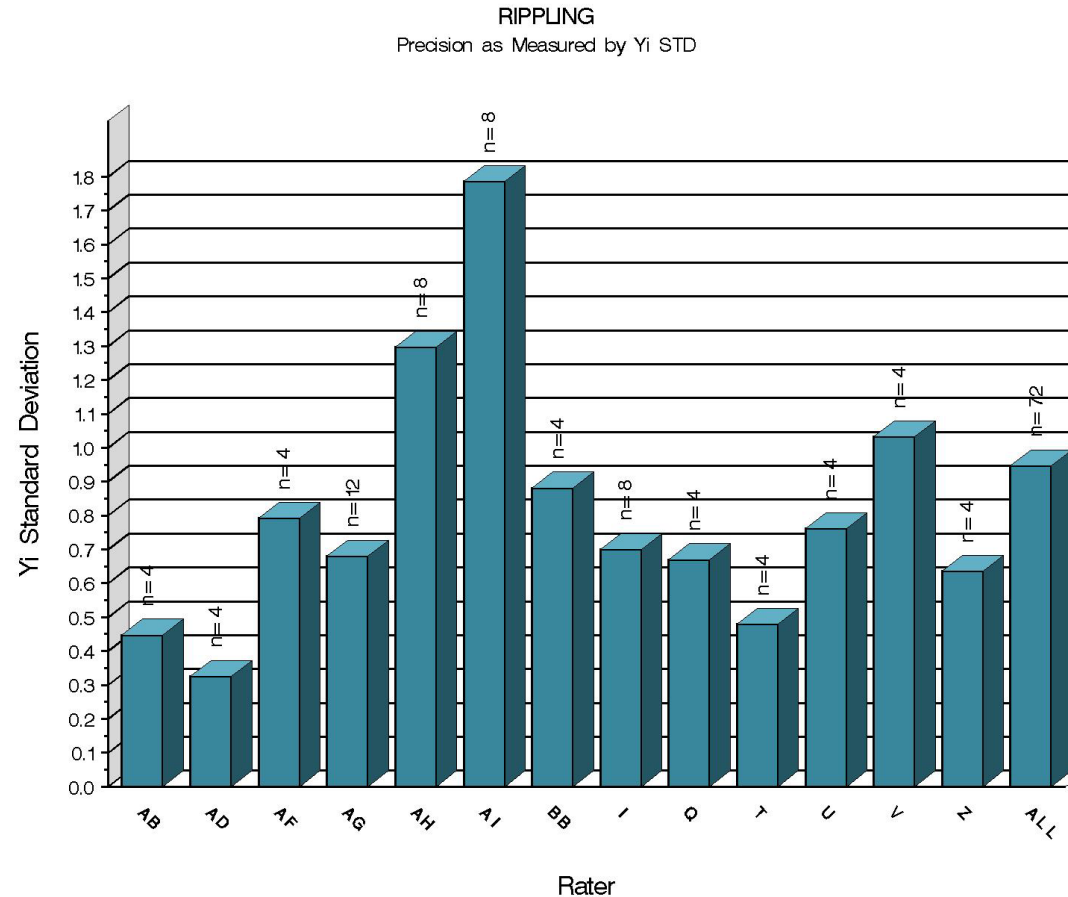
12:55:48 13MAY2025

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Test Monitoring Center
<https://www.astmtmc.org>



L37RC Precision Estimates



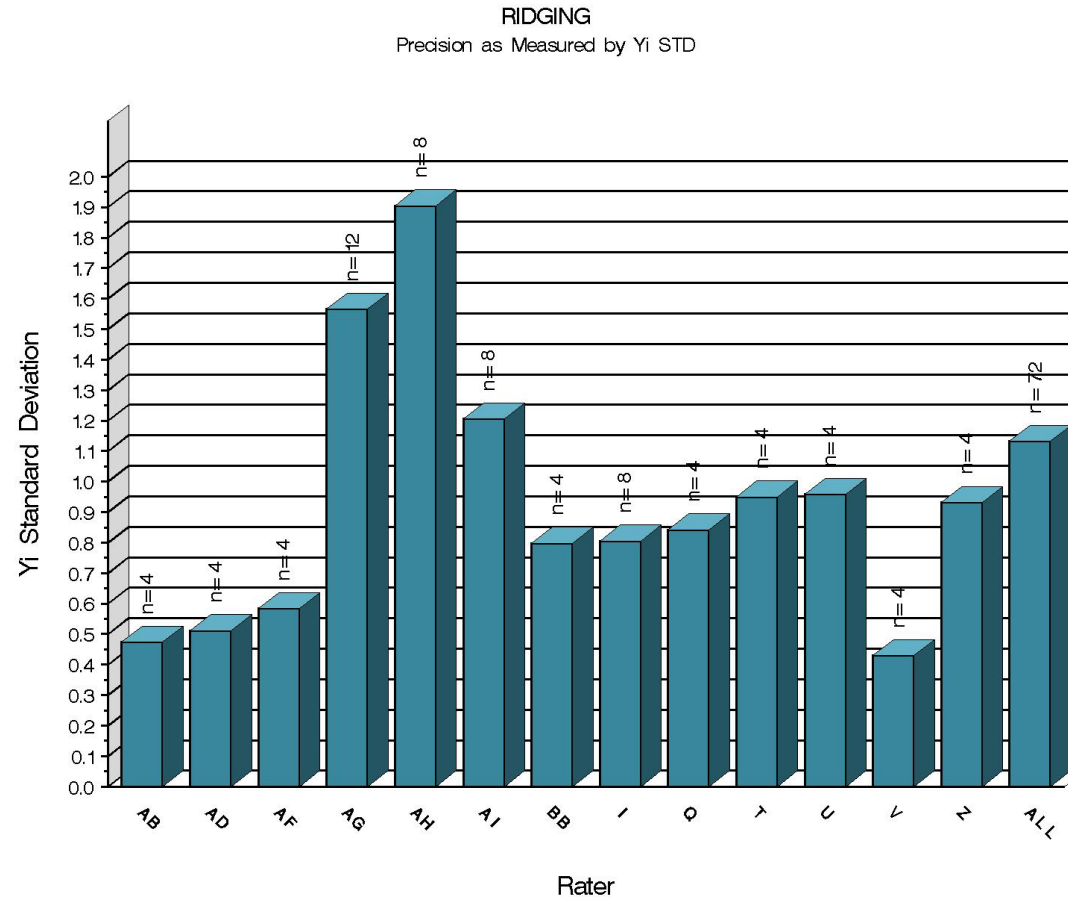
12:55:49 13MAY2025

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Test Monitoring Center
<https://www.astmtmc.org>



L37RC Precision Estimates



12:55:48 13MAY2025

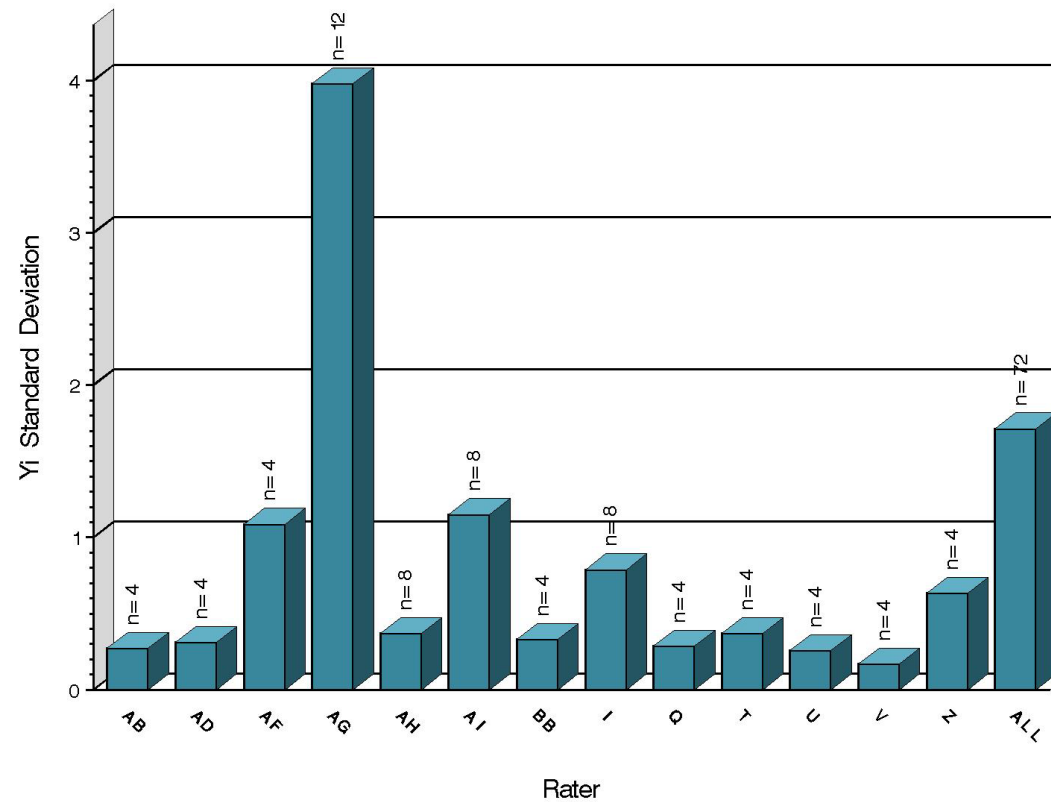
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Test Monitoring Center
<https://www.astmtmc.org>



L37RC Precision Estimates

SPITTING
Precision as Measured by Yi STD



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Test Monitoring Center
<https://www.astmtmc.org>



L42RC

➤➤ April 2025

L42RC Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	14
Unacceptable Calibration Test	OC	2
Total		16

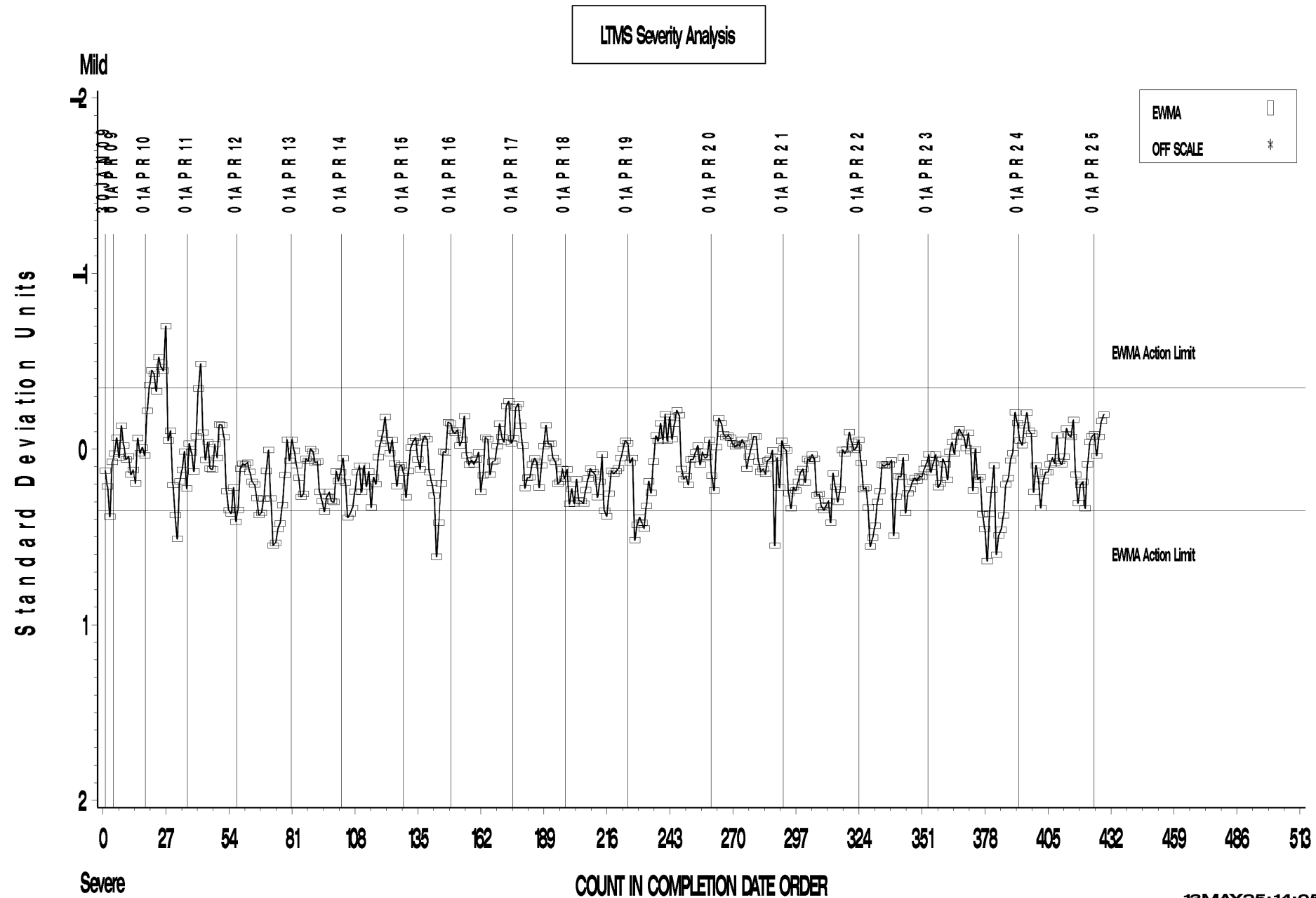
L42RC – Failed Test

Test Status	Validity Code	#
Unacceptable Calibration Test (Severe)	OC	2
Total		2

L42RC Test Severity

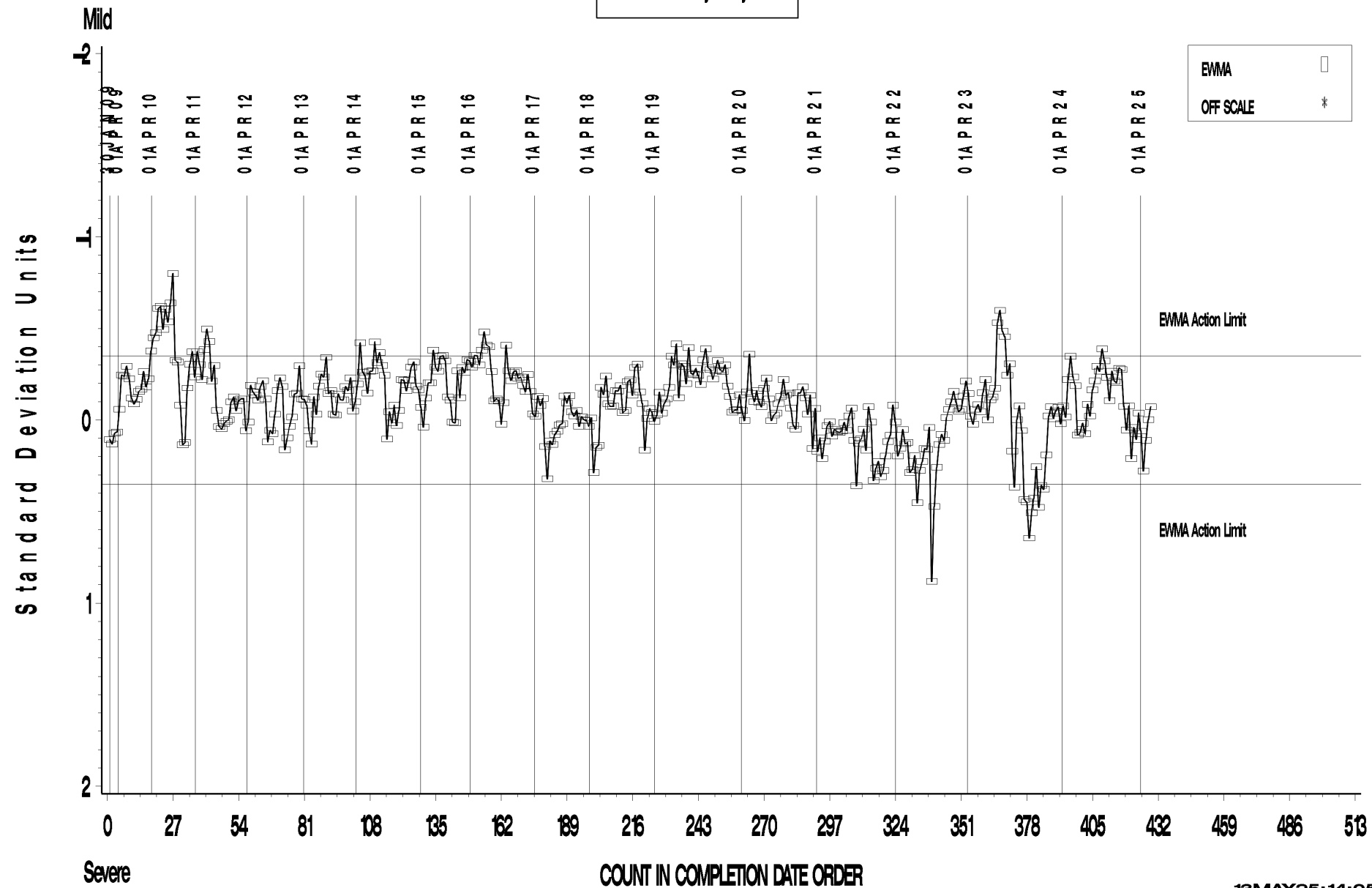
- Severity:
 - All parameters remained within the limits this reporting period.
- Precision:
 - All parameters remained within the limits this reporting period.

PINION SCORING



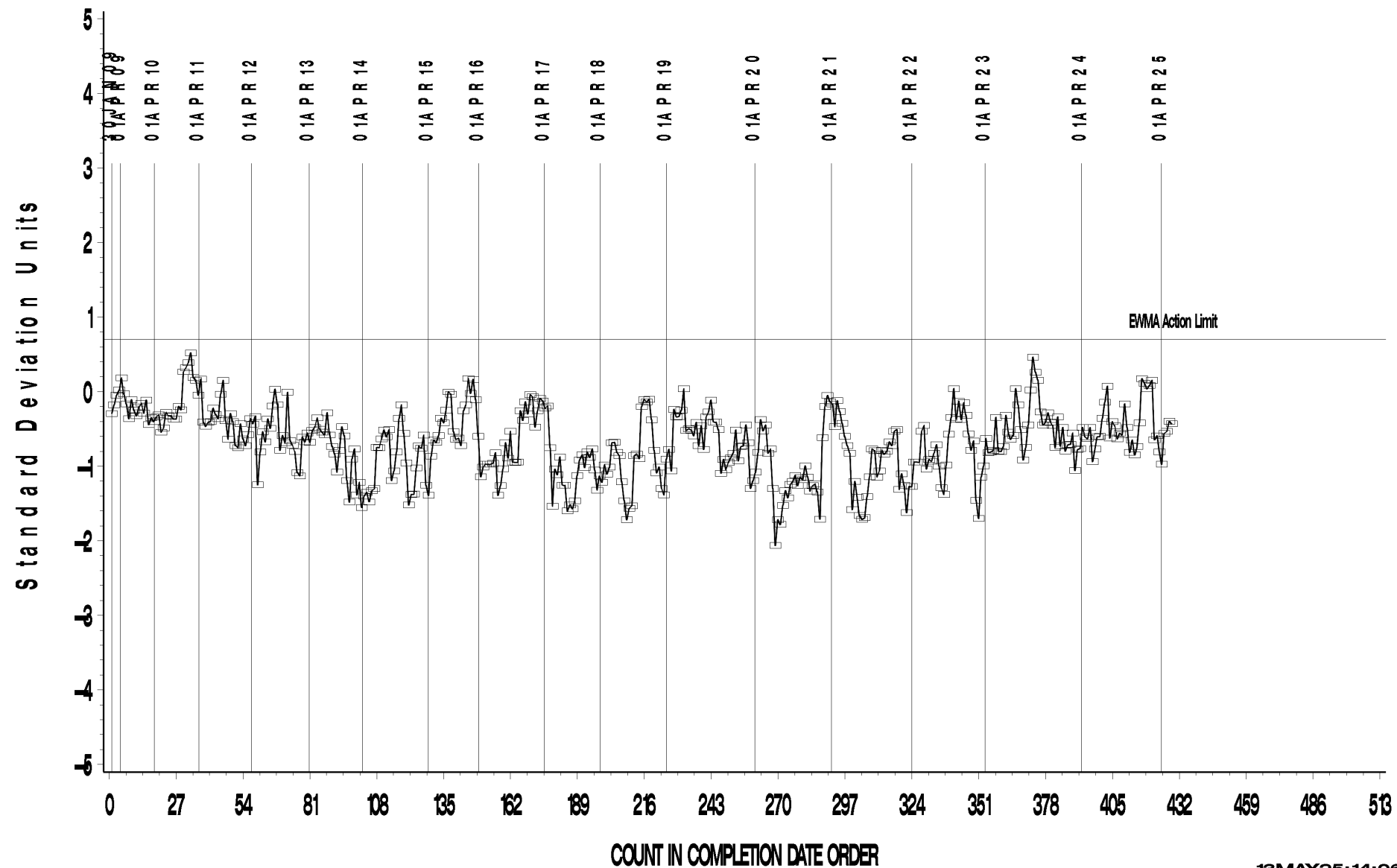
RING SCORING

LTMS Severity Analysis



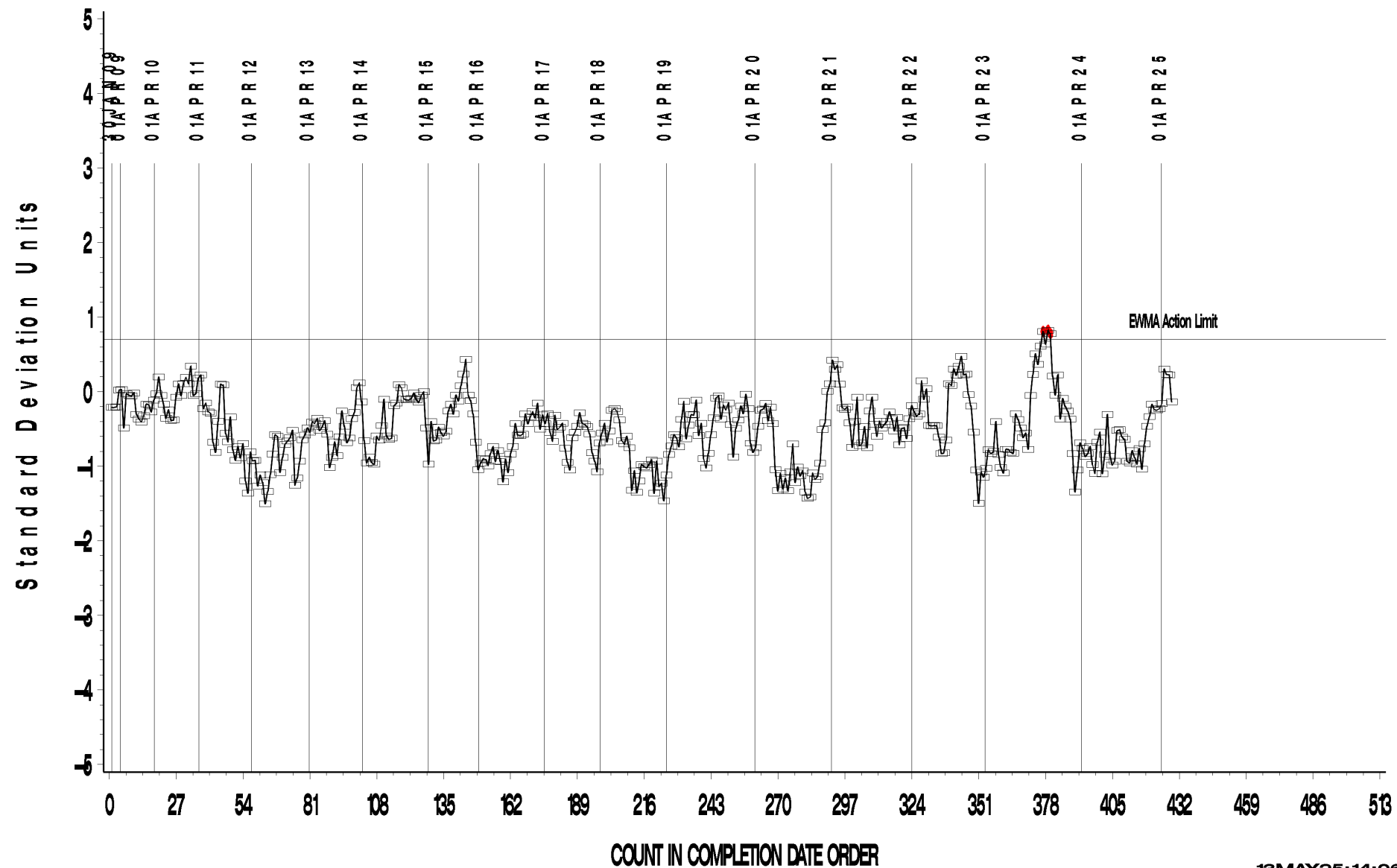
PINION SCORING

LTMS Precision Analysis



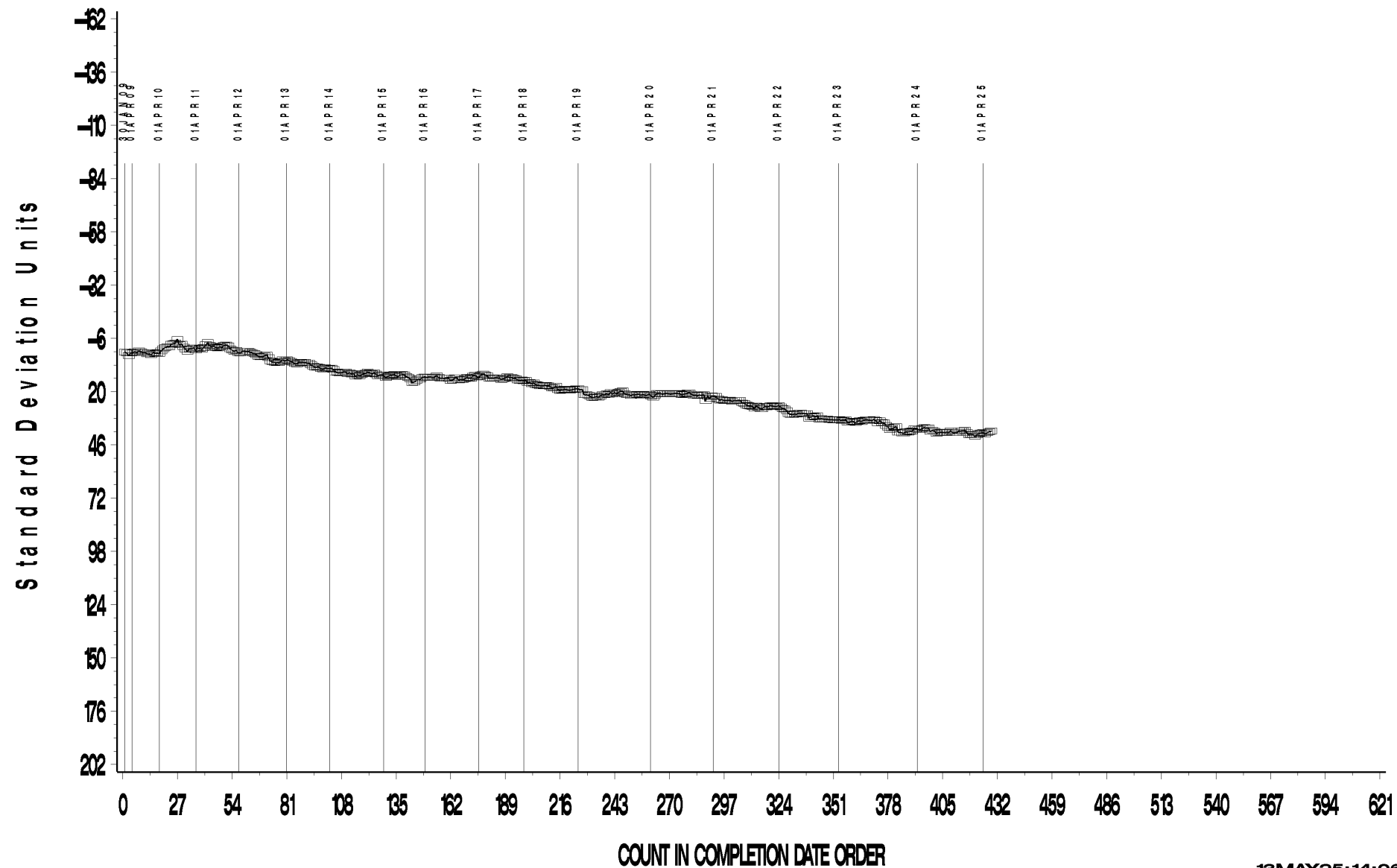
RING SCORING

LTMS Precision Analysis



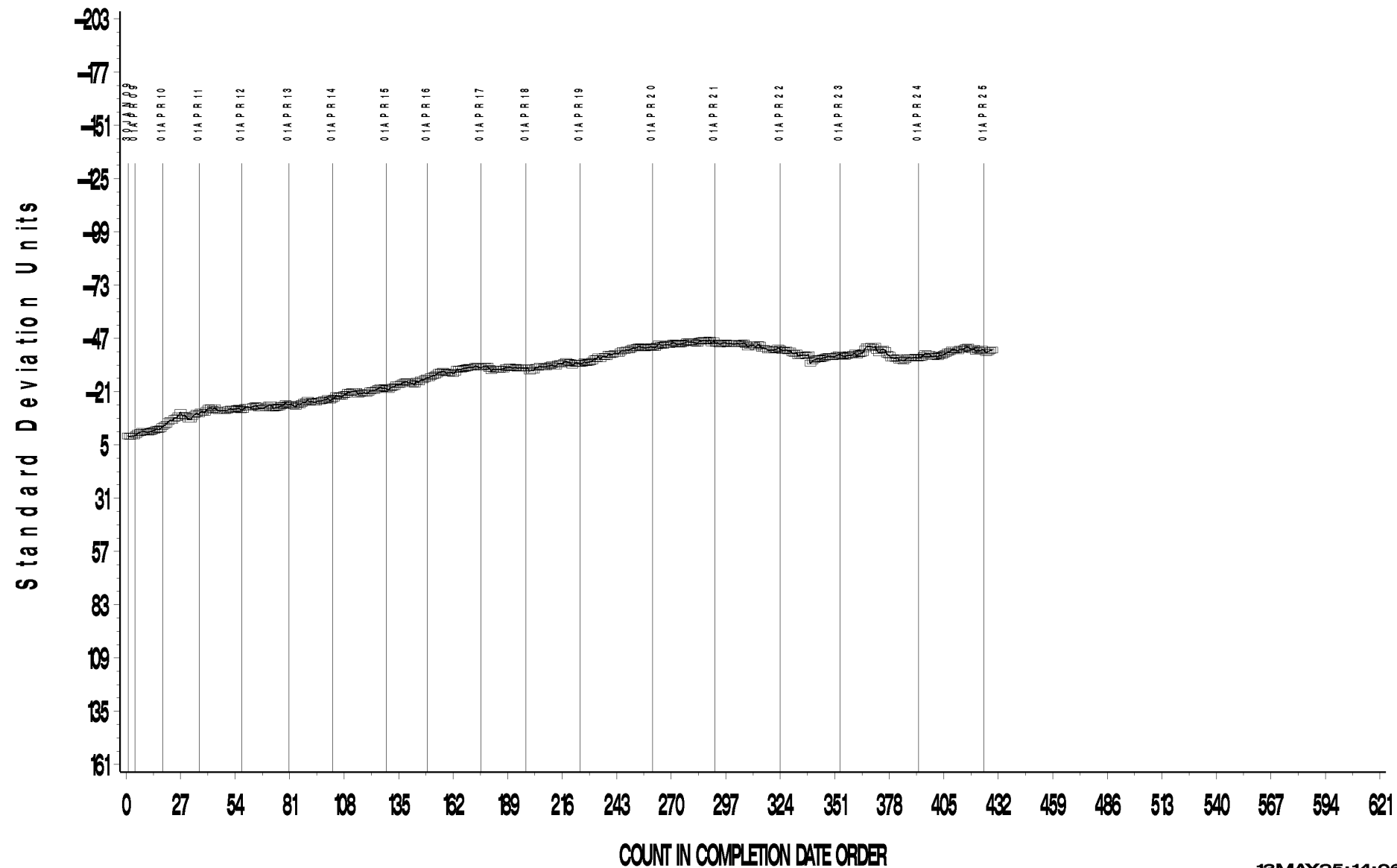
PINION SCORING

CUSUM Severity Analysis



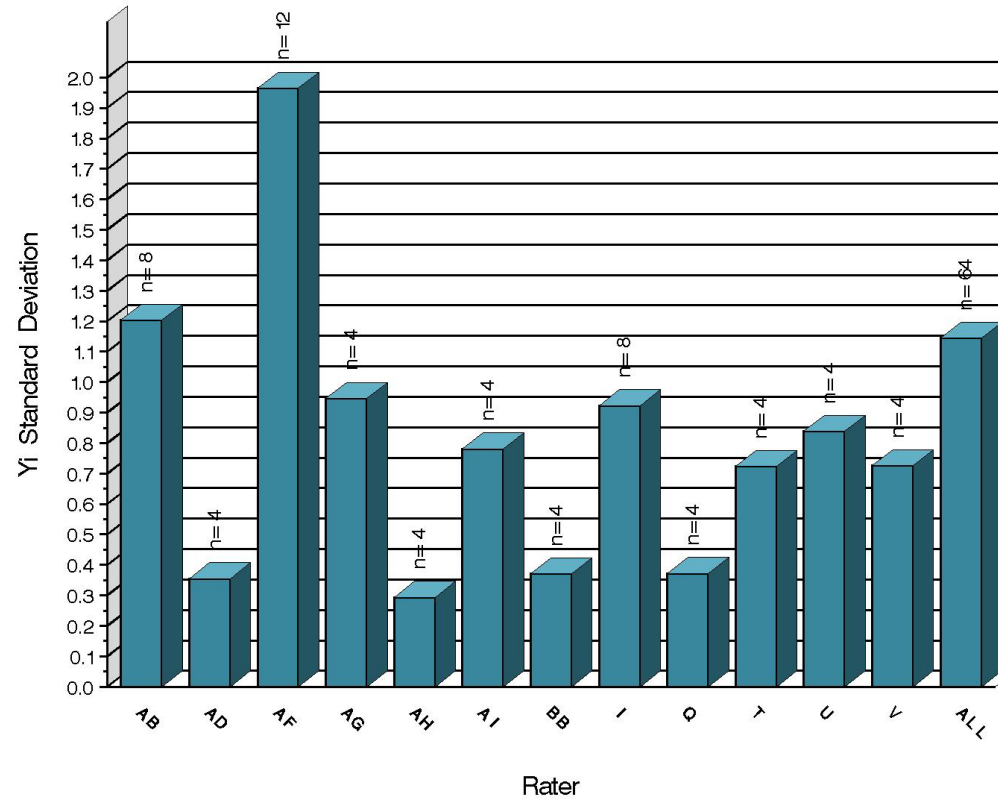
RING SCORING

CUSUM Severity Analysis



L42RC Pinion Scoring Estimates

PINION SCORING
Precision as Measured by Y_i STD



14:01:03 13MAY2025

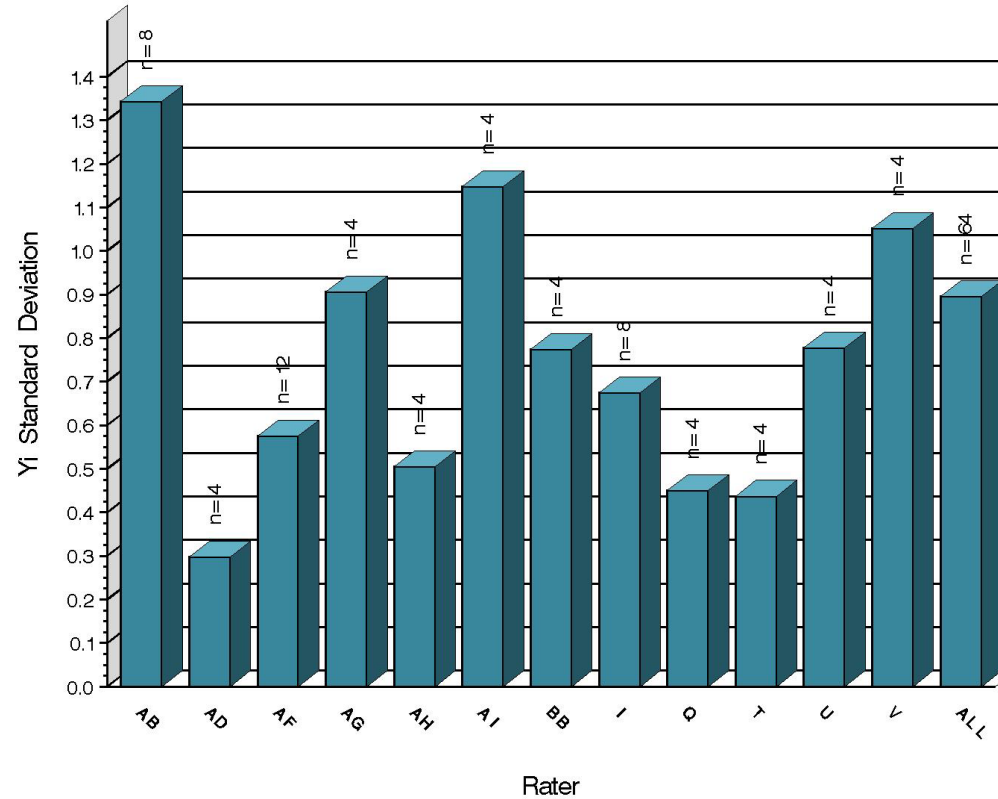
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Test Monitoring Center
<https://www.astmtmc.org>



L42RC Ring Scoring Estimates

RING SCORING
Precision as Measured by Yi STD



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Test Monitoring Center
<https://www.astmtmc.org>



L-60-1

➤➤ April 2025

L-60-1 Activity

Test Status	Validity Code	#
Acceptable Calibration Test	AC	14
Failed Calibration Test	OC	8
Aborted Calibration Test	XC	0
Operationally Invalid Calibration Test	LC	0
Acceptable Information Run	NI	7
Total		29

L-60-1 Failed Tests

Test Status	Validity Code	#
Failed Calibration Test (Mild)	OC	3
Failed Calibration Test (Severe)	OC	5
Total		8

L-60-1 – Lost Tests

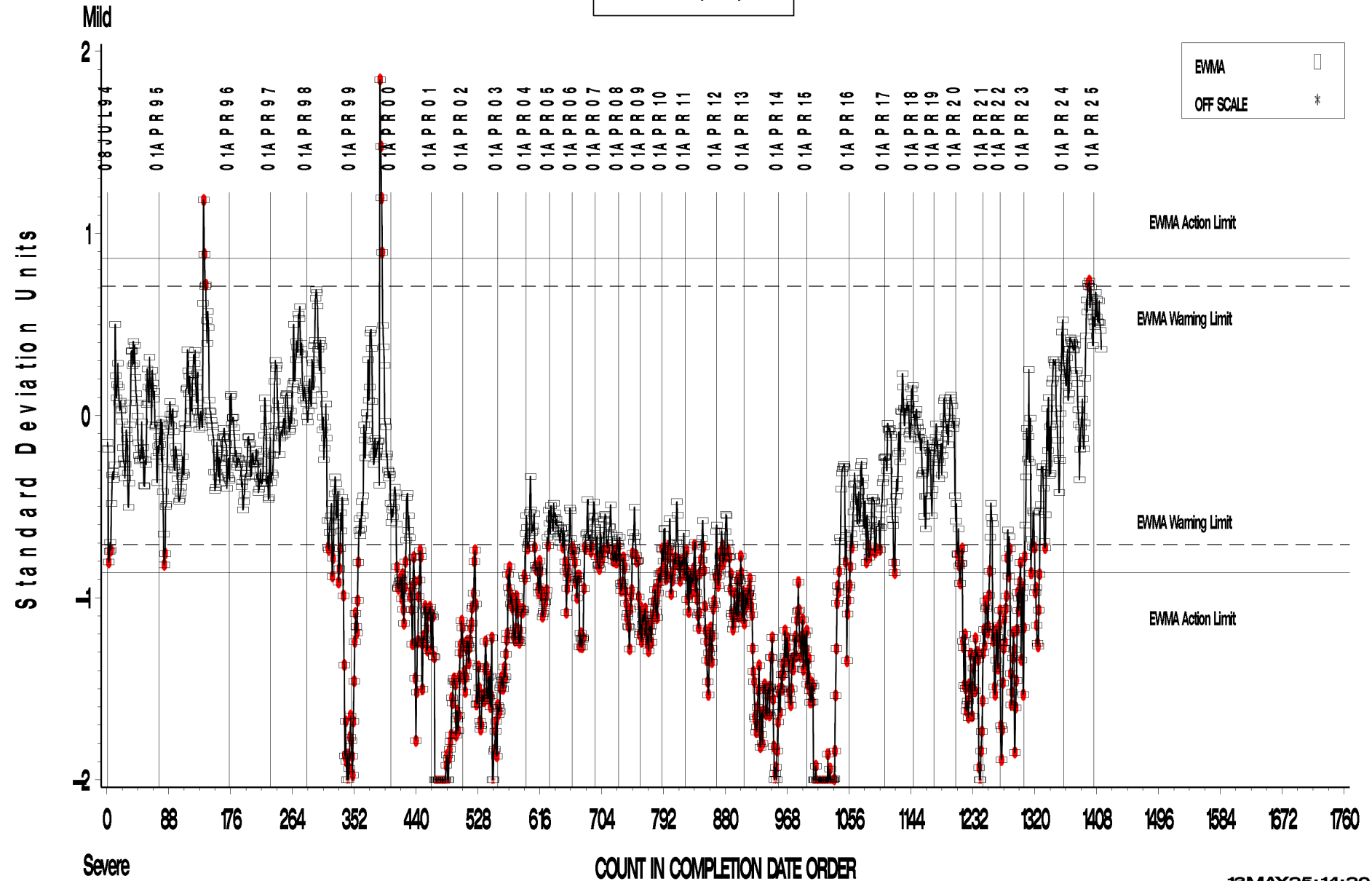
Test Status	Validity Code	#
No lost test this period		
Total		0

L-60-1 Test Severity

- **Severity:**
 - ASL exceeded the action limit this period in the mild direction and has since returned within limits.
 - PEN, TOL finished the reporting period exceeding the action limit in the mild direction.
 - VISI finished the reporting period exceeding the action limit in the severe direction.
- **Precision:**
 - VISI ended the reporting period exceeding the action limit

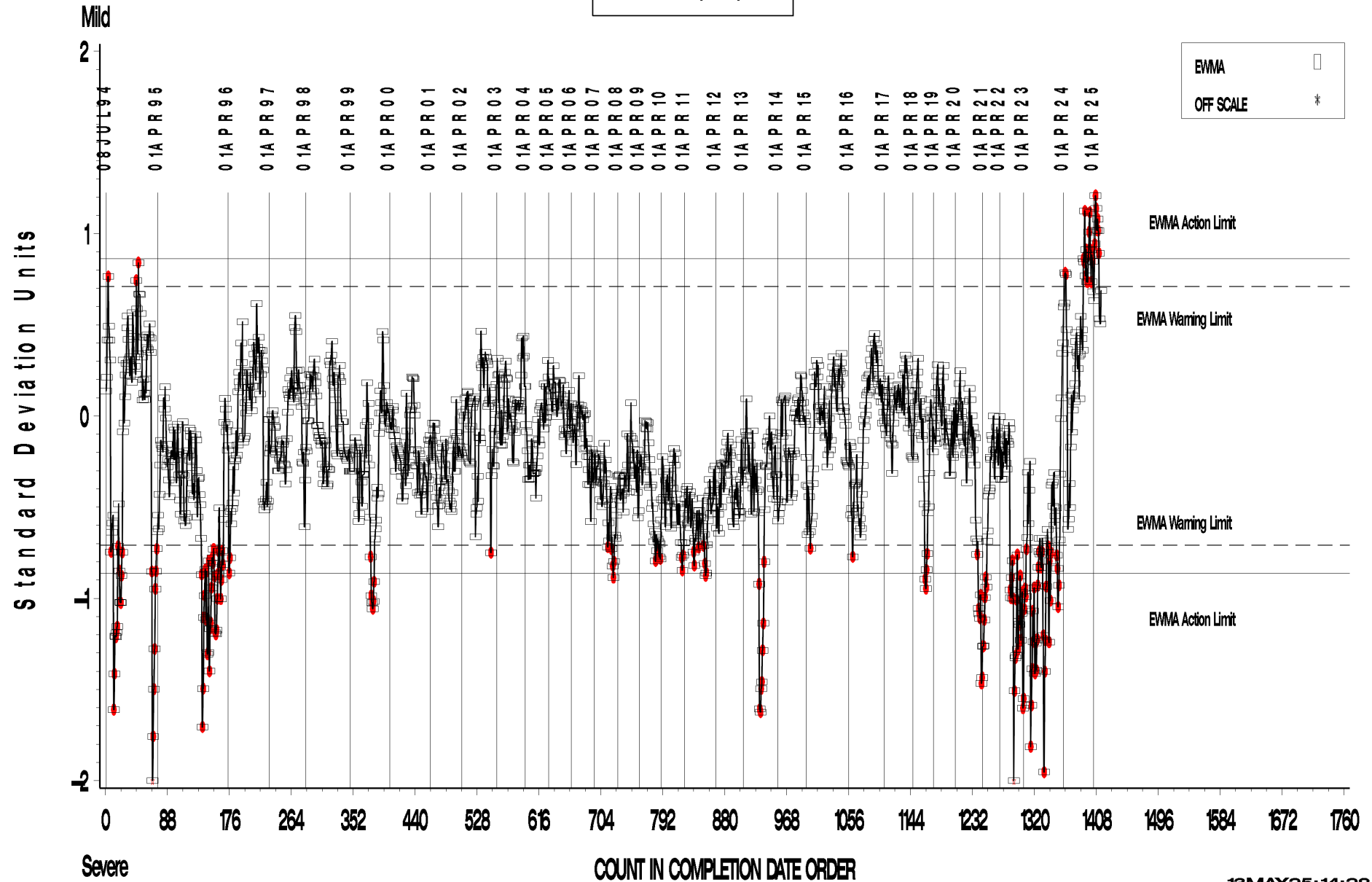
REF. FINAL AVERAGE CARBON/ VARNISH

LTMS Severity Analysis



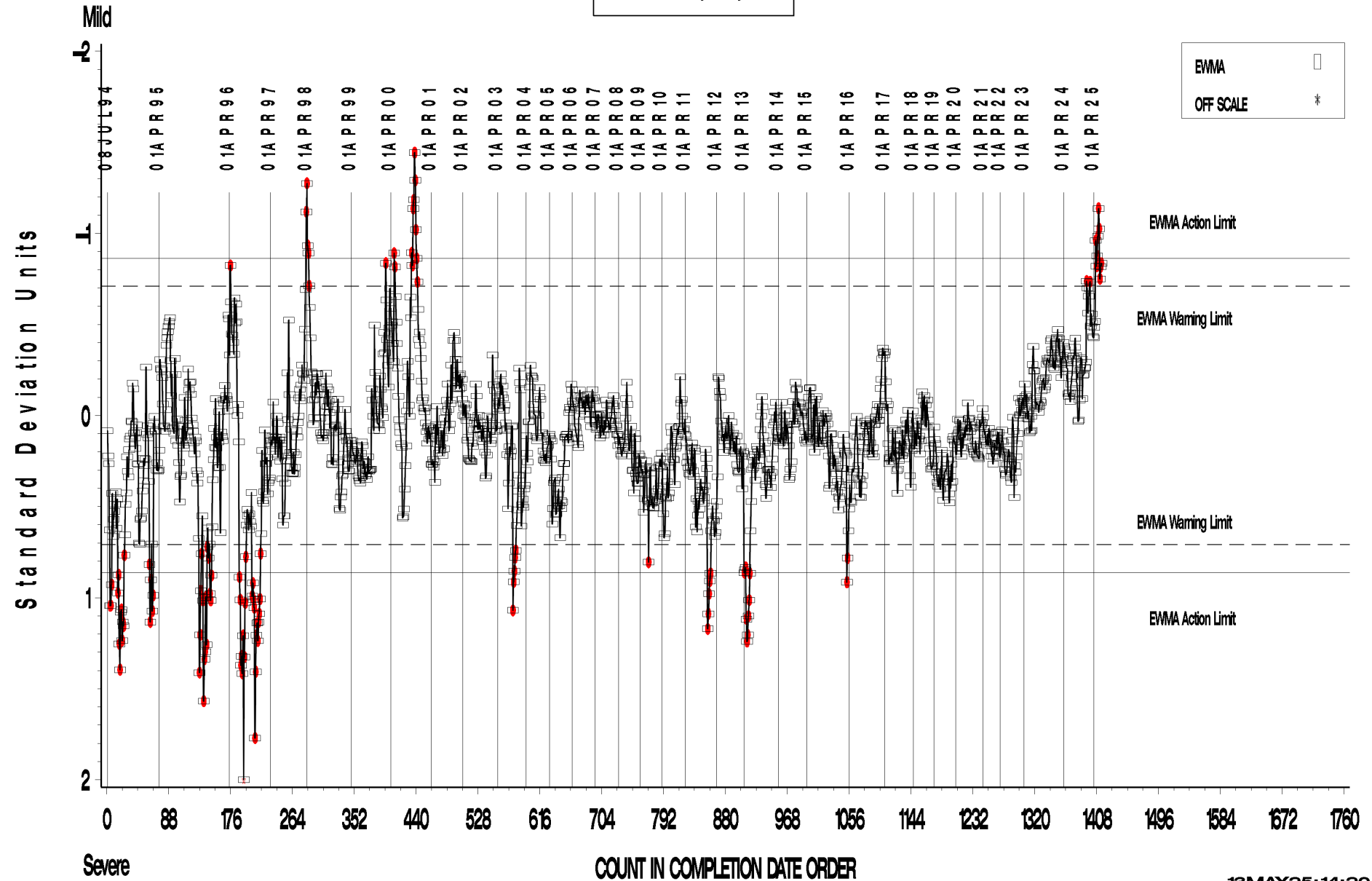
REF. FINAL AVERAGE SLUDGE

LTMS Severity Analysis



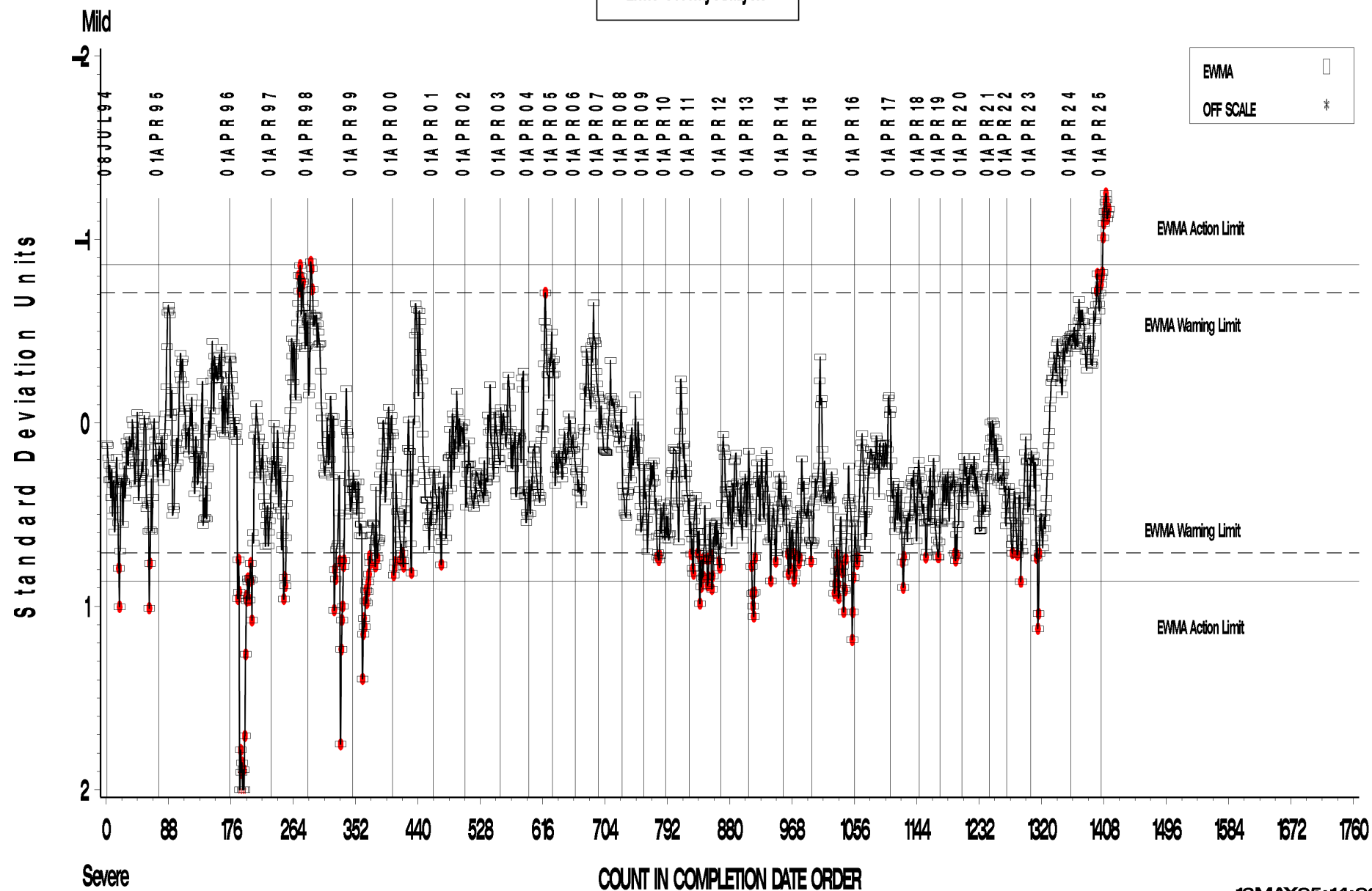
REF. FINAL PENTANE INSOLUBLES

LTMS Severity Analysis



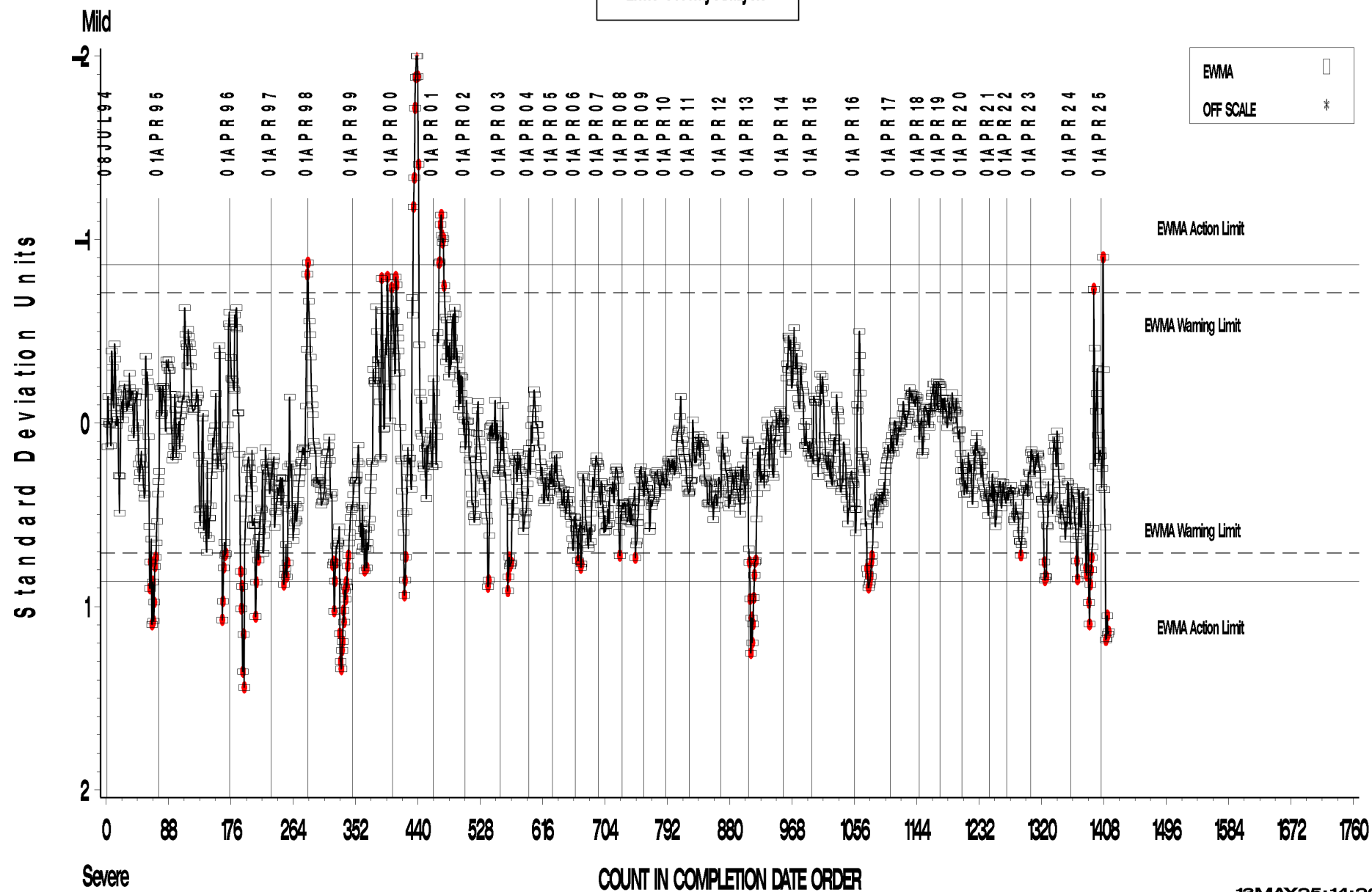
REF. FINAL TOLUENE INSOLUBLES

LTMS Severity Analysis



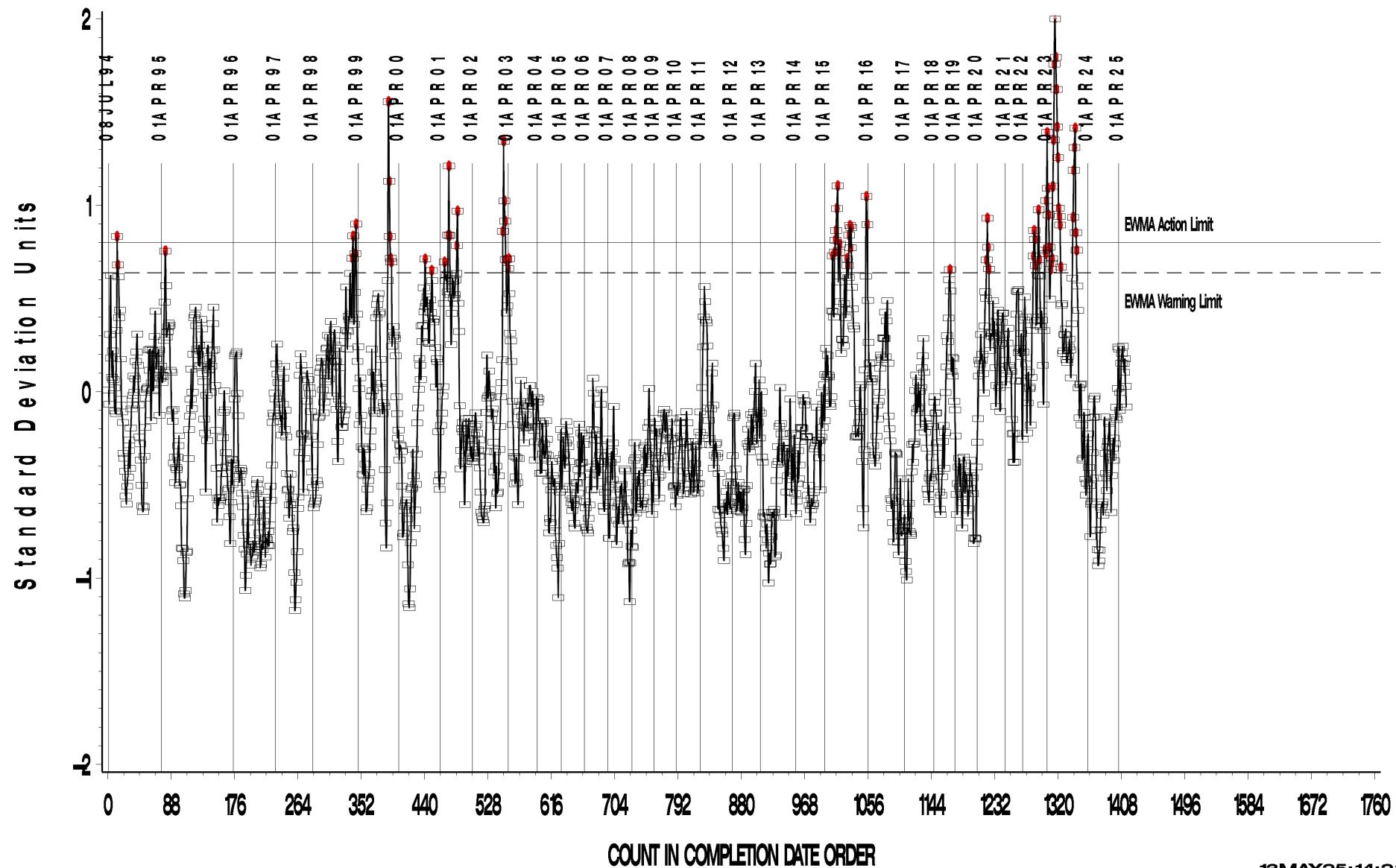
REF. FINAL VISCOSITY INCREASE

LTMS Severity Analysis



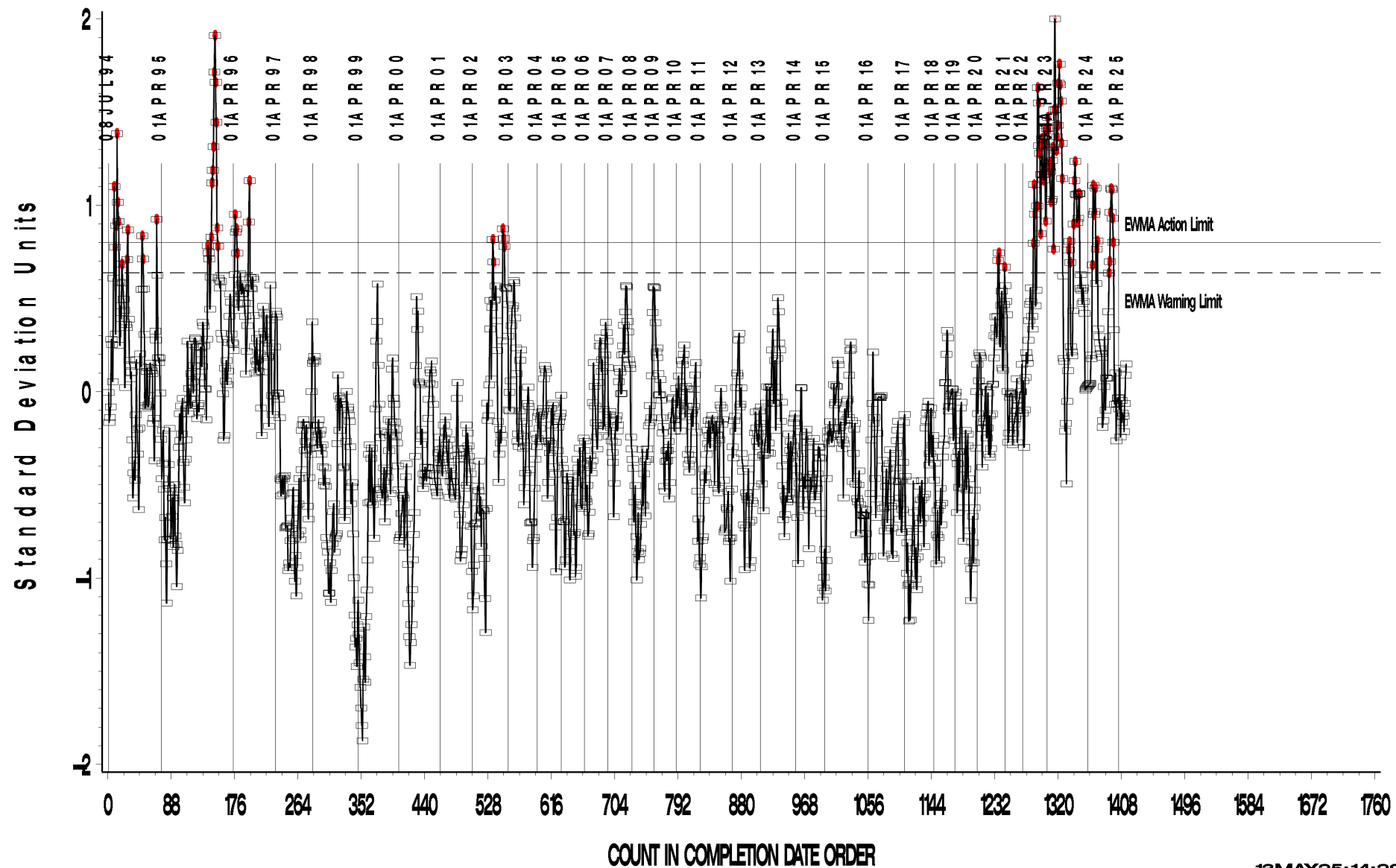
REF. FINAL AVERAGE CARBON/ VARNISH

LTMS Precision Analysis



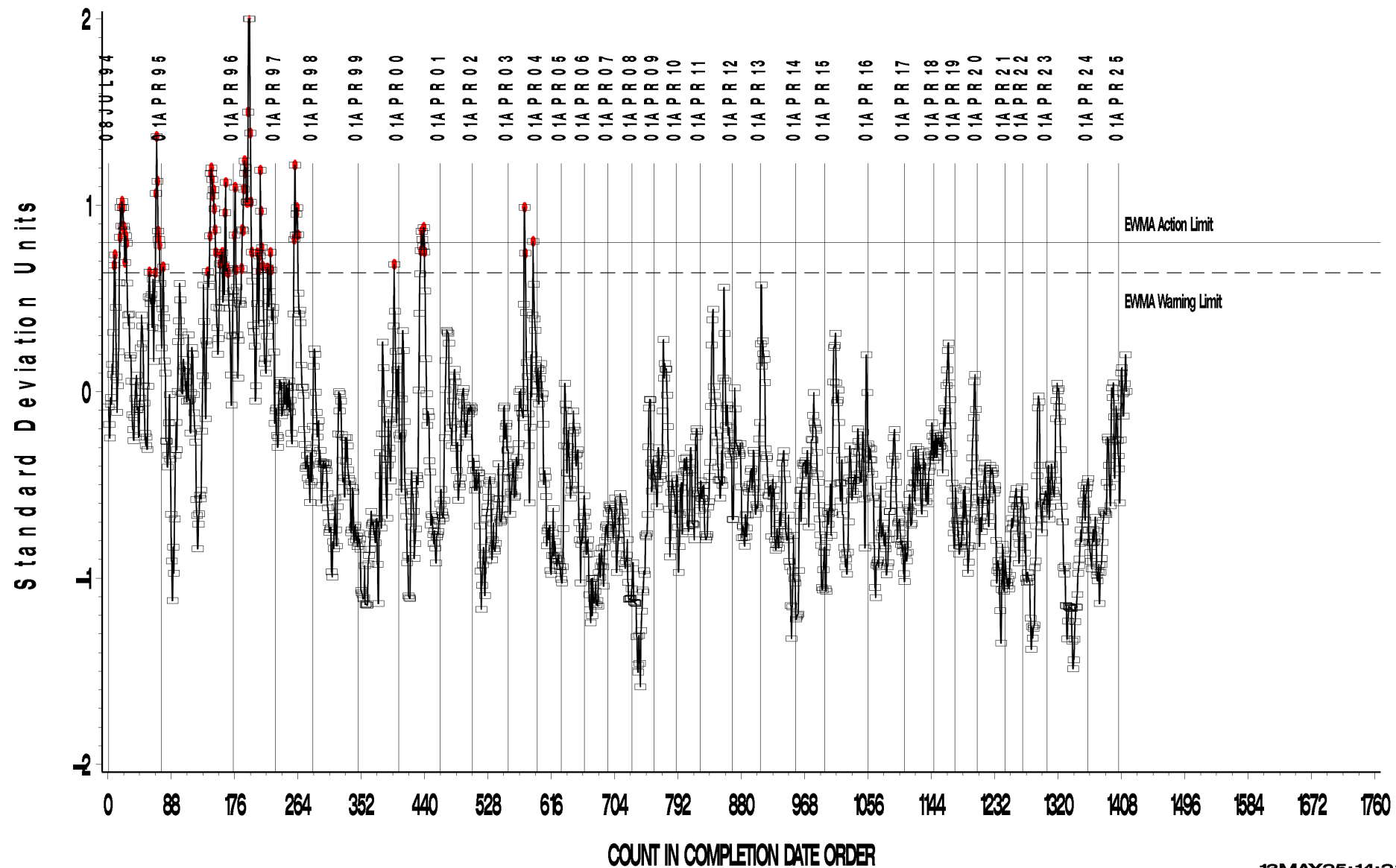
REF. FINAL AVERAGE SLUDGE

LTMS Precision Analysis



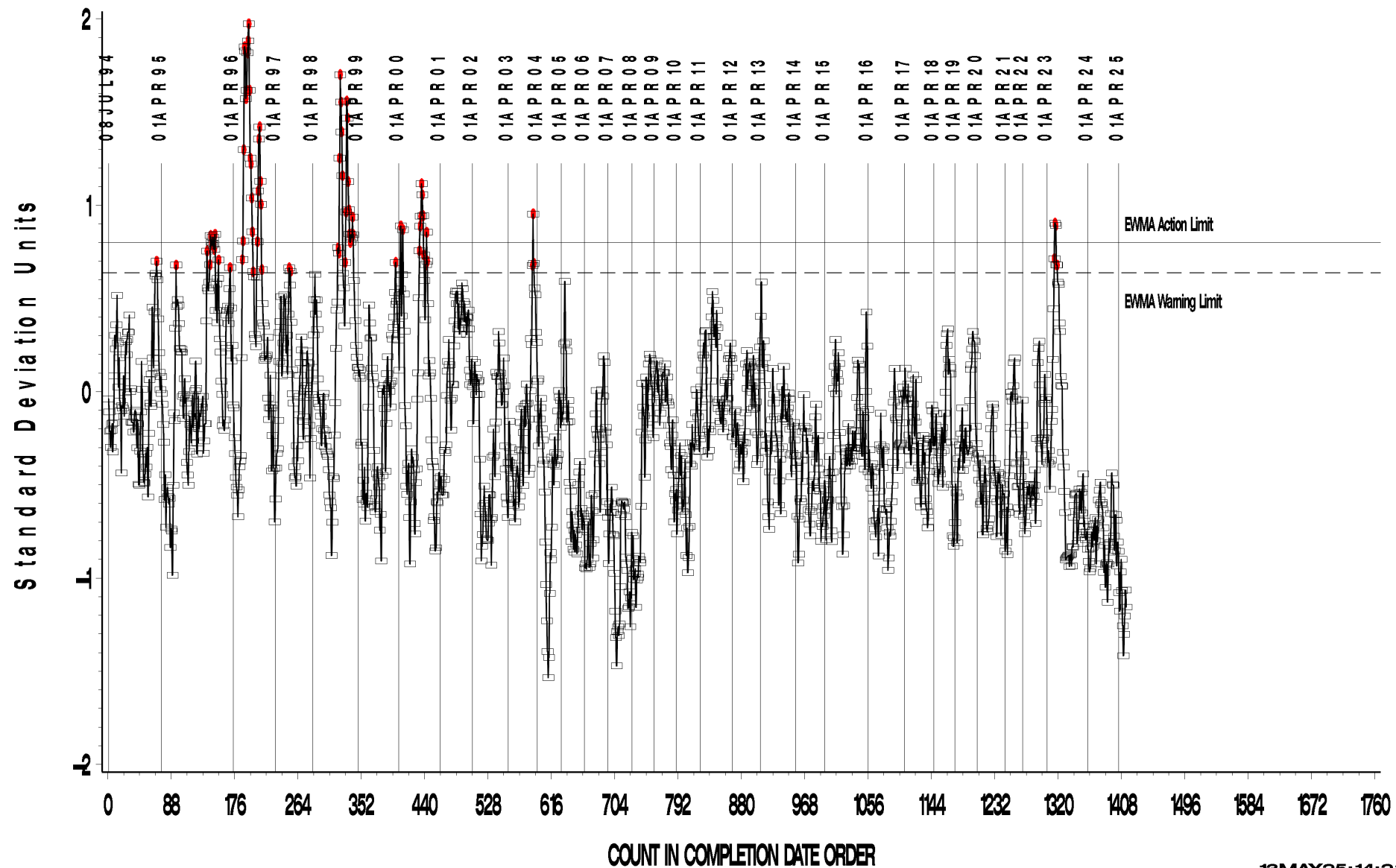
REF. FINAL PENTANE INSOLUBLES

LTMS Precision Analysis



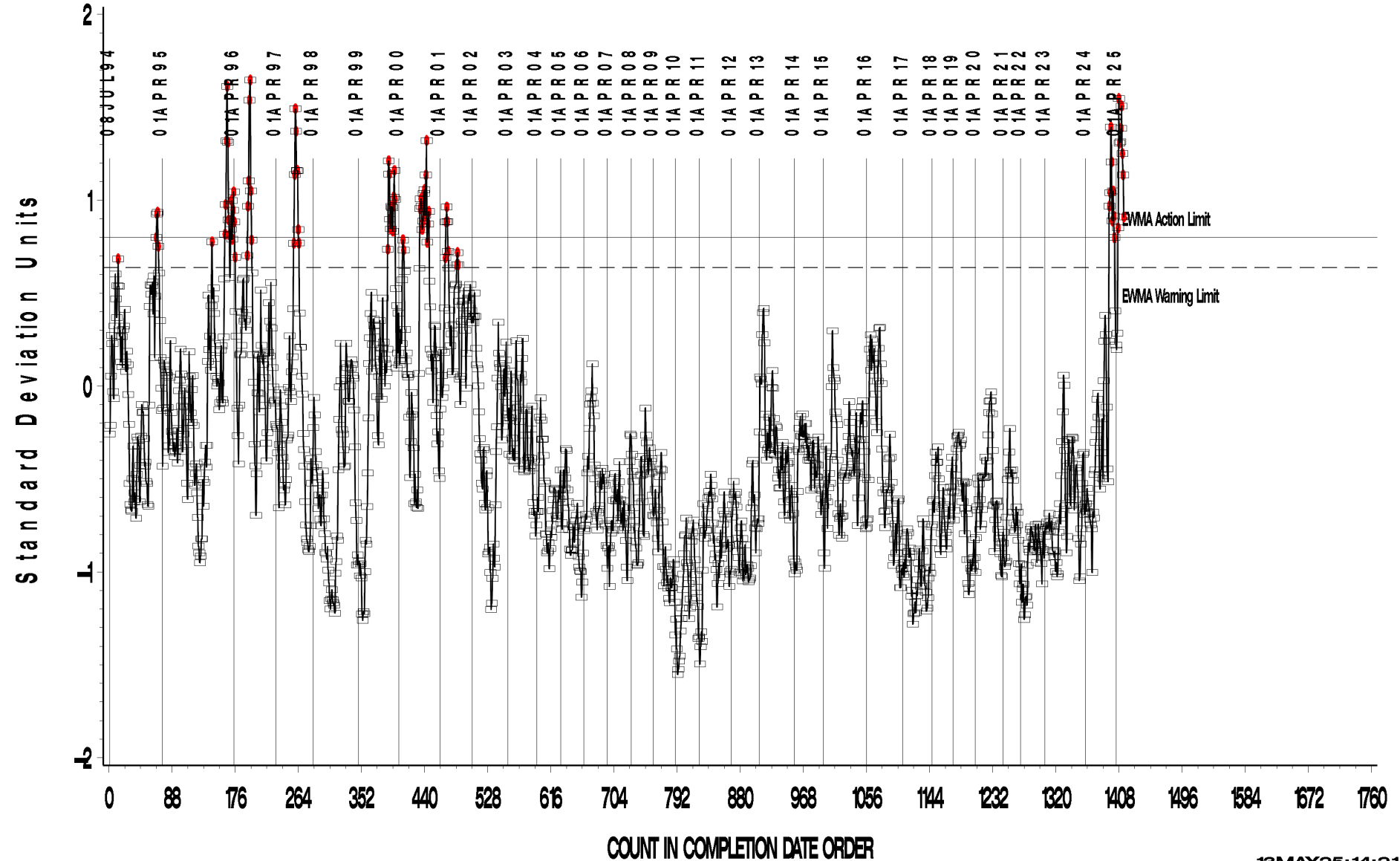
REF. FINAL TOLUENE INSOLUBLES

LTMS Precision Analysis



REF. FINAL VISCOSITY INCREASE

LTMS Precision Analysis

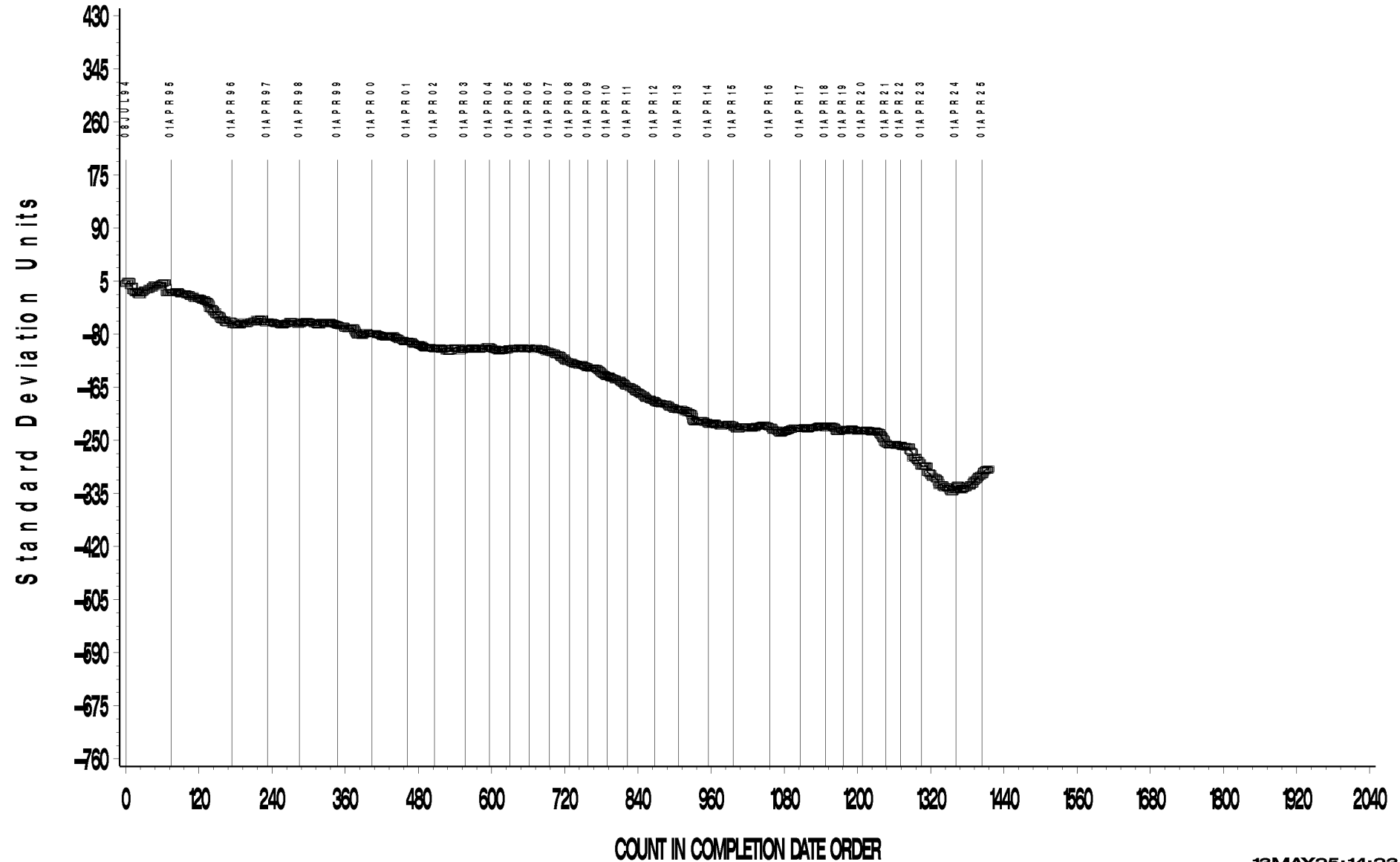


CUSUM Severity Analysis



REF. FINAL AVERAGE SLUDGE

CUSUM Severity Analysis



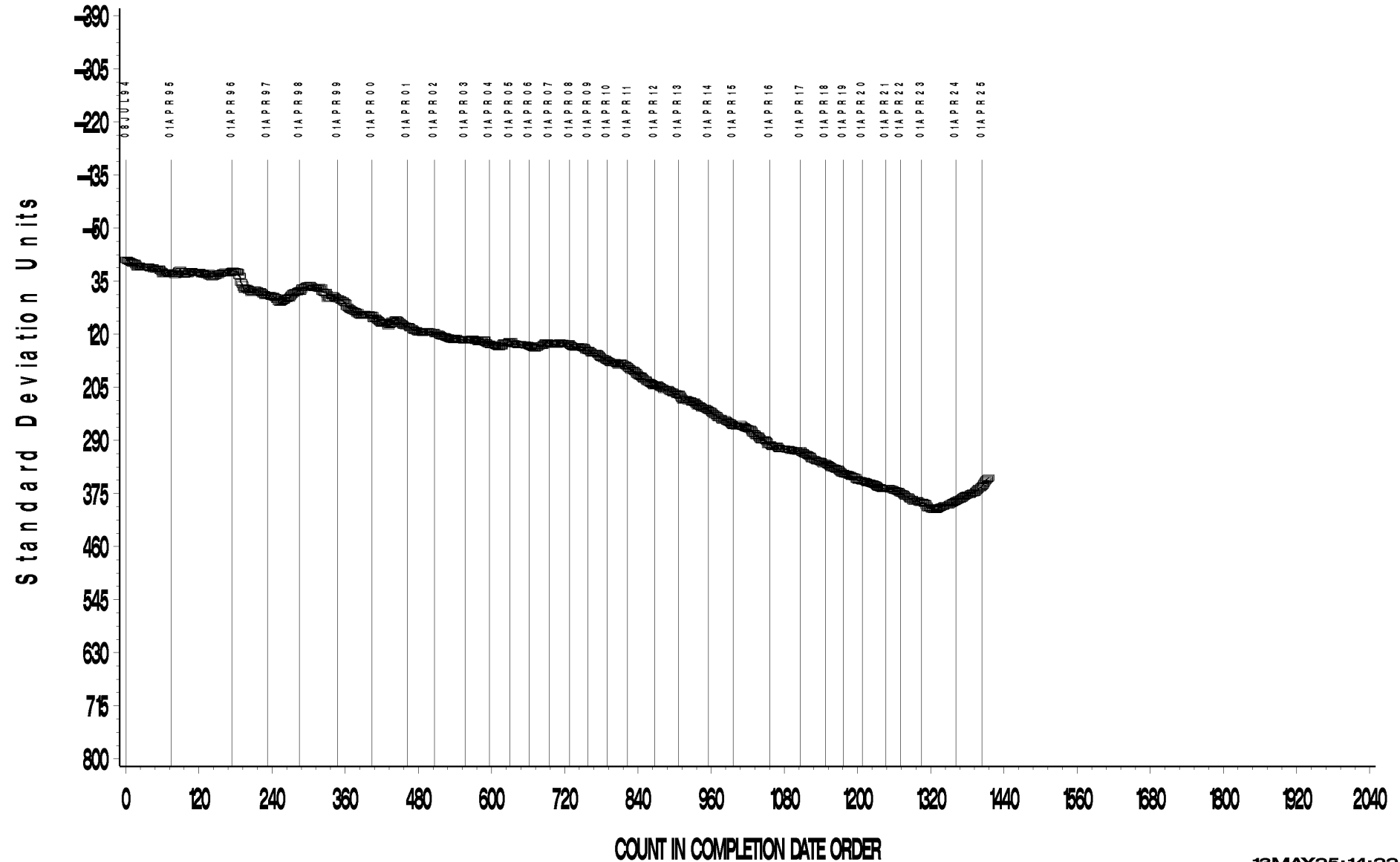
REF. FINAL PENTANE INSOLUBLES

CUSUM Severity Analysis



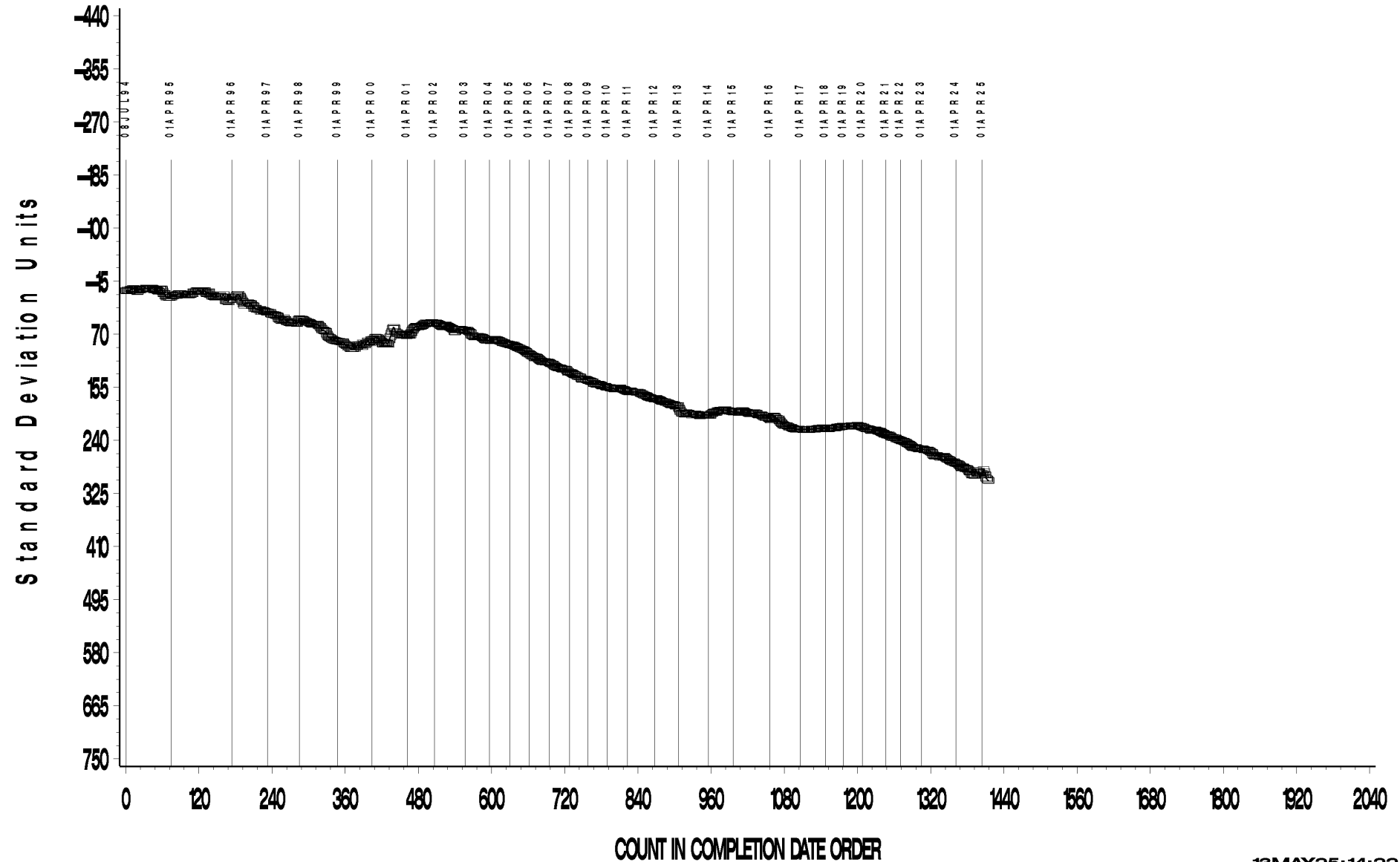
REF. FINAL TOLUENE INSOLUBLES

CUSUM Severity Analysis

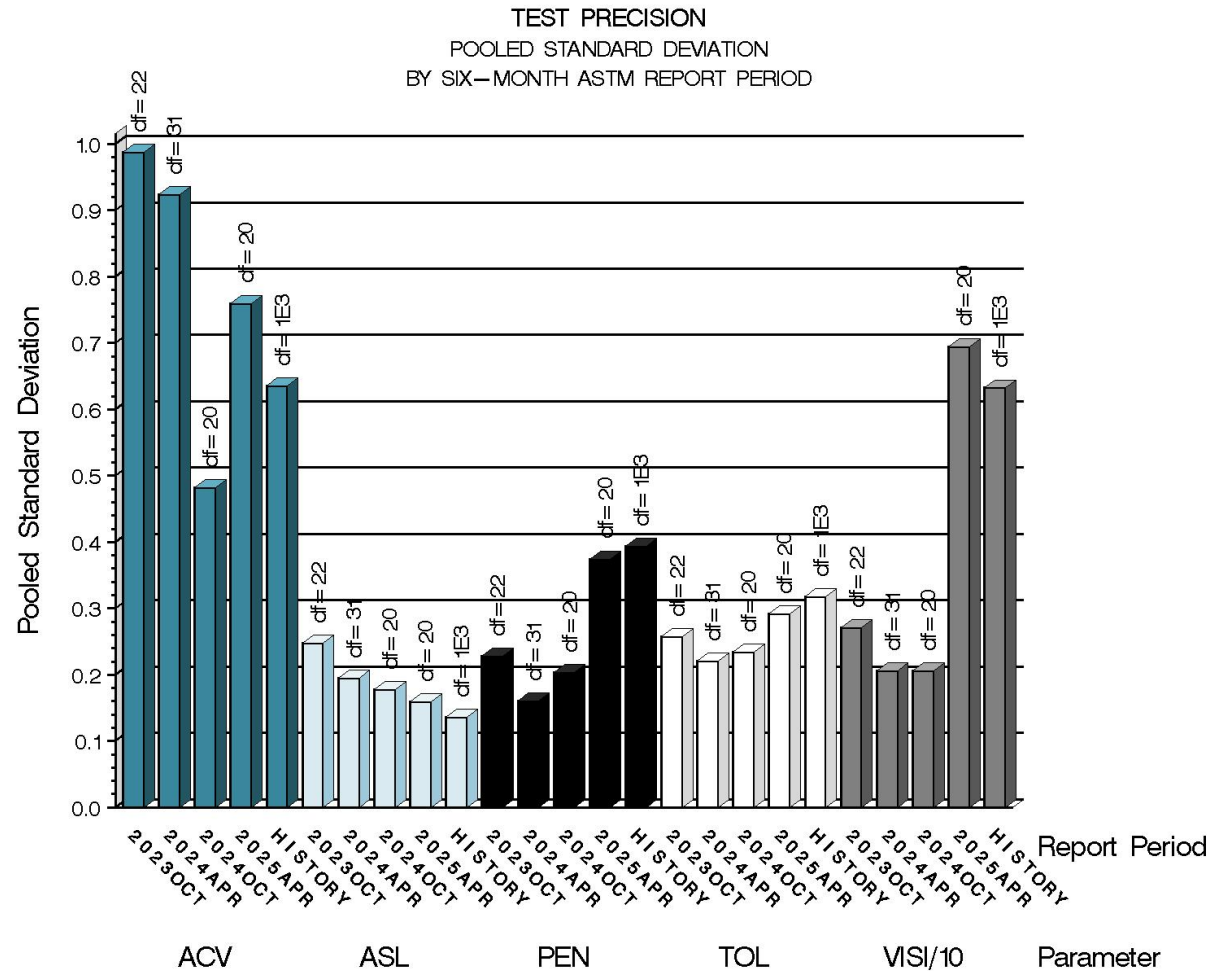


REF. FINAL VISCOSITY INCREASE

CUSUM Severity Analysis



L-60-1 Precision Estimates



due to the vastly larger reported results for VISI in relation to the other parameters, it is shown scaled by 0.1

14:12:57 13MAY2025

Information Letters



April 2025

Information Letters*

Test	Date	IL	Topic
L-60-1	20241204	24-2	Addition of cover O-ring part number 2-263.
L-33-1	20250306	25-1	Add reference to the critical parts list for hardware correction factors.

*Available from TMC Website

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Reference Oil Inventory



Actions, Re-blends, Inventories
and Estimated Life

Reference Oil Re-blends & Replacements

➤ TMC 172, 170-1, & 171-1 (OSCT Testing)

- TMC reference oil 172 is a replacement oil for 169. TMC 170-1 is a reblend of reference oil 170. TMC 171-1 is a reblend of 171. All three oils have been received by the TMC and approved for distribution. Testing matrices are currently underway at the two participating laboratories.

➤ TMC 145 (L-60-1 Testing)

- TMC 145 is a replacement oil for 148-1. 145 was approved by the surveillance panel with an effective date of 20250226 (see TMC memo 25-006).

Reference Oil Re-blends & Replacements Cont.

➤ TMC 119-1 (L42 Testing)

- 119-1 is a reblend of 119. This is the discrimination oil for L-42 testing. 119-1 was approved by the surveillance panel with an effective date of 20241113 (see TMC Memo 24-032).

➤ TMC 155-2

- Reference oil 155-2 is a reblend of 155-1 and is used for multiple gear tests. It is an active reference oil for L-33-1, and L-60-1. During this period 155-2 was approved for L-37-1 testing with an effective date of 20250226 (see TMC Memo 25-004).

Reference Oil Inventory Estimated Life

Oil	Tests	Year	Blend Quanti	TMC Invento	Estimated Li	Comment
117	L-42	2013	550	218	7 years	A request has been put out to the panel for a replacement oil for 117
126	L-33-1	2022	105	63	5 years	
155-1	L-33-1, L-37-1, L-60-1, HTCT, OSCT	2010	495	27.14	1.5 years	No longer in test use
155-2	L-33-1, L-37-1, L-60-1, HTCT, OSCT	2020	265	193.7	5 years	
134-1	L-37-1	2015	220	98	8 years	
152-2	L-37-1	2009	275	37.3	2 years	
119	L-42	2018	54	7.2	1 year	No longer in test use
119-1	L-42	2024	54	45	5 years	Approved by panel Nov 2024
145	L-60-1	2024	48	46.5	6 years	Replacement for 148-1. Approved for test use
169	OSCT	2010	275	105.6	7 years	
170	OSCT	2015	52	18	2 years	
171	OSCT	2017	53	0	0 years	TMC inventory has been depleted.
172	OSCT	2024	108	105	8 years	Replacement for 169. Not yet approved by panel for test use
170-1	OSCT	2024	51.5	49.1	8 years	Reblend of 170. Not yet approved by panel for test use
171-1	OSCT	2024	54	49.6	5 years	Reblend of 171. Not yet approved by panel for test use

LTMS Deviations

»» October 1, 2024 – March 31, 2025

LTMS Deviations

- No LTMS Deviations this period

TMC Laboratory Visits

➤➤ October 1, 2024 – March 31, 2025

Test Monitoring Center
<https://www.astmtmc.org>



TMC Lab Visits

Test	Number of Labs Visited
OSCT	0
L-33-1	0
L-37-1	1
L-42	1
L-60-1	1

Lab Visit Issues

- ▶ L-60-1:
 - During an inspection in October 2024, it was discovered that an O-ring part number did not match the specified part number in the test procedure. Part number 2-264 was specified and 2-263 was being used. The lab stated that the 2-263 part number fit their cover plate better than the specified 2-264 part number. This issue was corrected with information letter 24-2. This information letter adds 2-263 as an acceptable part number.

Test Area Timelines

➤➤ October 1, 2024 – March 31, 2025

Test Area Timeline Additions*

Test	Date	Topic	IL
L-42-1	20241119	Discrimination oil 119-1 introduction	TMC Memo 24-032
L-60-1	20251204	Addition of O-ring part number 2-263	IL 24-002
L-37-1	20250219	Reference oil 155-2 introduction	TMC Memo 25-004
L-60-1	20250221	Reference oil 145 introduction	TMC Memo 25-006
L-33-1	20250306	Add reference to the critical parts list for hardware correction factors.	IL 25-01

Rating Workshop Data

➤➤ January 2025 Gear Rating Workshop

Rating Workshop Data

- ▶ Gear rating workshop data can be found on the TMC website:
 - https://www.astmtmc.org/ftp/refdata/gear/rating_workshop_data/

Miscellaneous Information

- ▶ Available on TMC Website:
 - Live Reference Test Data Bases
 - Surveillance Panel Meeting Minutes
 - Test Area Alarm Logs
 - Complete Test Area Timelines
 - LTMS Manual

- ▶ <https://www.astmtmc.org>

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